SCIENTIFIC AMERICAN

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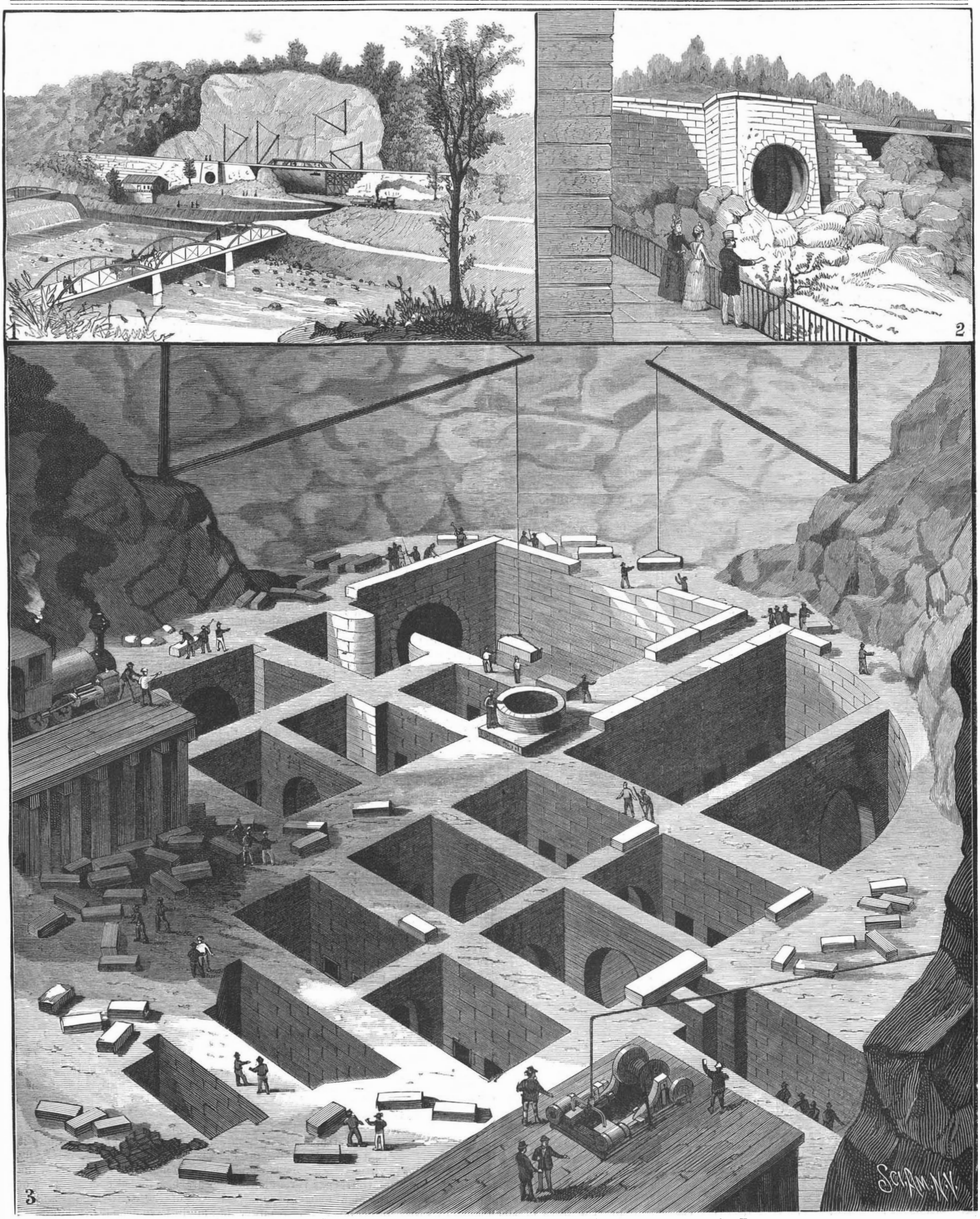

1. Croton Dam, Surface Inlet, and Site of New Gate House. 2. Surface Inlet. 3. Work in Progress on the New Gate House.

THE GATE HOUSE AND NORTHERN TERMINUS OF THE NEW YORK AQUEDUCT.—[See page 87.]

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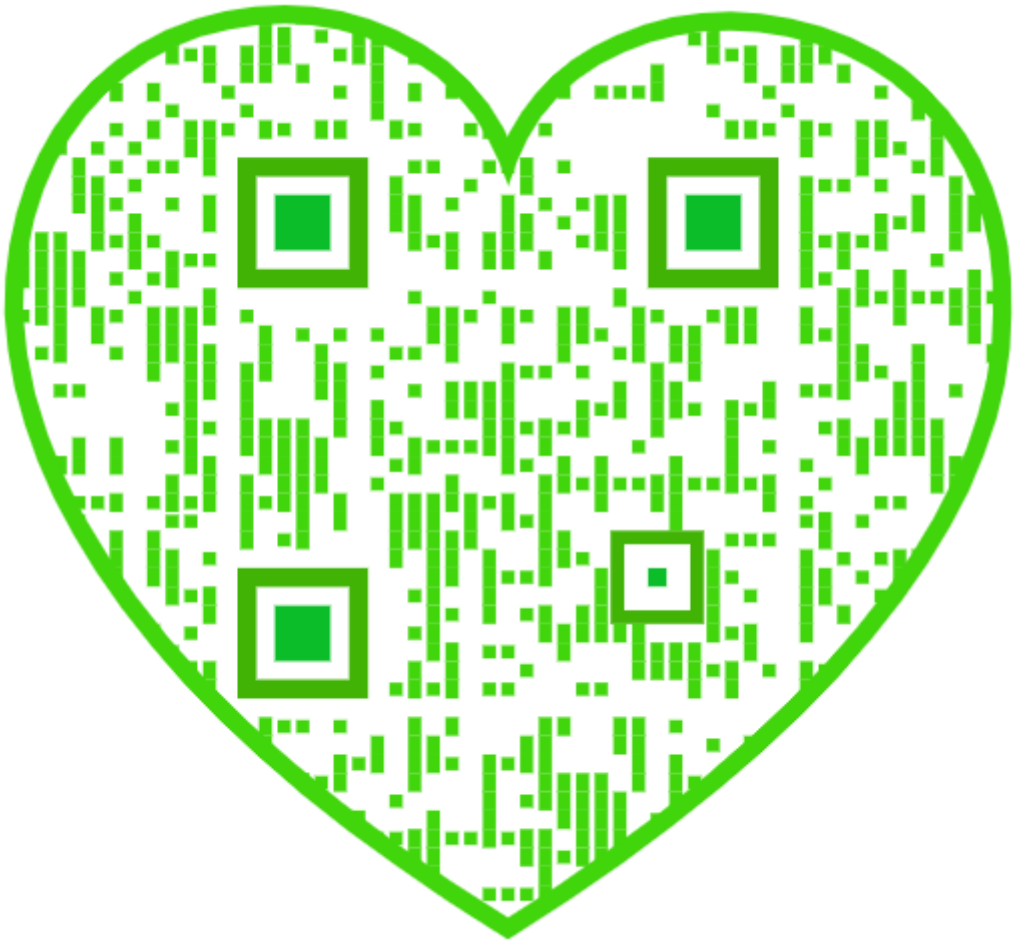

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Contents.

(Illustrated articles are marked with an asterisk.)

Auk, great, the home of the..... 80
Balloons, naval..... 85
Bank protector, the poppy as a... 89
Batteries, primary, of light weight..... 84
Boats, pleasure, an improved propeller for*..... 84
Breakwater, Santa Monica, Cal... 89
Bridge, the Forth*..... 86
Bridge, the St. Louis..... 86
British frozen meat imports..... 88
Business and personal..... 90
Clean your grain..... 83
Comb, curry, an improved*..... 84
Conscience, human, the..... 80
Dye, a seaweed..... 86
Ericsson at 85..... 80
Flue cleaner, an improved*..... 83
Gate, farm, an improved*..... 83
Gate house and northern terminus of the new aqueduct, the* 79, 87
Glass balls for refilling wine casks 84
Grouse, sand*..... 89
Heating buildings by exhaust steam..... 80
Horsemanship, Indian..... 88
Insulating material, valuable..... 84
Inventions, agricultural..... 90
Inventions, engineering..... 90
Inventions, index of..... 91
Inventions, miscellaneous..... 90
Iron and steel, the mysteries of.. 85
Lace machine, the Jumbo..... 86
Life, city, injurious influences of. 80
Light, electric, English decisions relating to..... 81
Life, the storage of..... 85
Mars, ice on..... 84
Mechanical movement, an improved*..... 83
Mica, artificial..... 88
Mosquito as blessing to man, the. 87
Motor, current, an improved*... 82
New steel casting process..... 88
Notes and queries..... 90
Oil can, an improved*..... 84
Ores, low grade, electricity in the reduction of..... 81
Panama Canal, plant and machinery of the..... 82
Physics, simple experiments in*.. 87
Poisons and their antidotes..... 81
Preserving food, the egg shell method of..... 84
Press, punching and forging, multiple*..... 82
Railroad, boat, Columbia River.. 81
Shingling hammer and plane, a combined*..... 84
Straw paper making in Germany. 81
Tea, a new constituent of..... 88
Tea, Canadian..... 85
Tin, American..... 82
Trade mark decision, interesting. 88
Trains, speed of..... 81
Traps, grasshopper..... 85
Trees in Washington..... 89
Trepang, Canadian..... 81
Truck for locomotives and street motors, improved*..... 83
Wages in Scotland..... 84
Weather strip, an improved*..... 83
What the result will be..... 80

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 658.

For the Week Ending August 11, 1888.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—Fungus Diseases in Plants—Their Treatment.—A valuable paper on the application of fungus-destroying substances to plants.—1 illustration..... 10517

II. CIVIL ENGINEERING.—Improved Water Ballast Steam Roller.—A roller for road making in which water is used as ballast.—3 illustrations..... 10503
The Hawkesbury Bridge, Australia.—A remarkable engineering feat executed by American engineers in Australia.—Details of operations.—4 illustrations..... 10504

III. GEOGRAPHY AND EXPLORATION.—Norfolk Island.—By ISAAC ROBINSON, U. S. Consul.—The story of the settlement of the island and its anomalous position.—A government with few laws and no prisons..... 10511
The Projected Railway from Winnipeg to Hudson's Bay.—The scene of the proposed route and the natural difficulties in way of the proposed line..... 10506

IV. GEOLOGY.—Coal, Asphalt, and Petroleum Deposits in Venezuela.—A description of the great richness of Venezuela in these deposits..... 10515
Geology.—By ARCHIBALD GEIKIE, LL.D., F.C.S.—The first installment of an exhaustive treatment of the subject of rock formation.—The formation of sedimentary rocks, with illustrations and experimental suggestions.—11 illustrations..... 10512

V. METEOROLOGY.—A Study on Whirlwinds.—A very interesting and graphic account of some personal observations of dust and snow vortices.—5 illustrations..... 10516

VI. MICROSCOPY.—Microscopical Measurements.—By CHARLES FASOLDT, SR.—The variations in such determinations due to difference in lights employed..... 10510

VII. NAVAL ENGINEERING.—New Additions to the French Navy.—Notes of dimensions and costs of some new vessels..... 10506
Steam Navigation.—The history of ocean steam transit.—A most interesting recital of early details of the inception of the great work..... 10503
The Propelling Machinery of Modern War Vessels.—Notes of a recent lecture on this subject.—By H. J. ORAM, Esq., Engineer, R. N..... 10506

VIII. PHOTOGRAPHY.—A New Method of Measuring the Time of Exposure given by Photographic Shutters.—A simple method for effecting this determination without the use of the electric light.—2 illustrations..... 10507
Photographic Notes.—Improving defective negatives.—A vexatious problem considered, with formulæ for varnish, intensifier, etc..... 10507
The Reproduction of Negatives.—By W. H. RAU.—How to make a negative from a negative; full practical details..... 10506

IX. PHYSICS.—Refrigerating Mixtures Obtained with Solid Carbonic Acid.—By L. CAILLETET and E. COLARDEAU.—A curious and important note on the role played by ether mixed with solid carbon dioxide in refrigeration..... 10518
The Photometry of Colors.—An interesting investigation in a hitherto comparatively untrodden field of work..... 10510

X. PHYSIOLOGY.—Effects of Food Preservatives on the Action of Diastase.—Pancreatic extract and pepsin.—By HENRY LEFFMANN, M.D., and WILLIAM BEAM, M.A.—An important question, and of growing importance in the light of the increasing use of food preservatives, experimentally treated; tables of results..... 10510

XI. TECHNOLOGY.—Apparatus for Dyeing, Cleaning, and Bleaching Textile Materials.—An interesting apparatus involving a distinct principle for treatment of thread on bobbins.—7 illustrations..... 10508
Distillation of Peppermint.—By ALBERT M. TODD.—How to make peppermint oil, a short and clear paper on the subject, with figures of manufacturing results..... 10509
Yellow Prussiate of Potash.—How this salt, the basis of Prussian blue manufacture, is made on the large scale..... 10509

ERICSSON AT 85.

The 85th anniversary of John Ericsson, the well-known inventor and mechanical engineer, was celebrated in this city on the 31st of July. Mr. Ericsson is still vigorous and still resides where he has lived for over a generation, at No. 36 Beach Street. All the other handsome dwellings in that vicinity were long ago given up to commercial uses; but the old philosopher declines to vacate. Long may he continue to hold the fort.

On the evening of the 31st ult., the venerable inventor was honored by a serenade by the United Scandinavian Societies, when the beautiful national hymn of Sweden was sung, and other Swedish music rendered. A special messenger from the King of Sweden and Norway also called on Mr. Ericsson to offer royal congratulations. For several years past Mr. Ericsson has been quite a recluse. Although it is stated he is in good health, it is rare that any one is allowed to see the old man. His body guard, Corporal Taylor, and other sentinels, forbid all approach, by orders, they claim, from headquarters.

"INJURIOUS INFLUENCES OF CITY LIFE."

So far as health is concerned, city life has its evils as well as its advantages. The experience of the civil war showed that farmers' sons cannot bear the fatigue of forced marches like city lads, and inferences have been drawn from this tending to belittle their powers that are scarcely warranted by the facts. City lads and men are used to much walking, many being on their feet all day, whereas, in the farming districts, it is the custom to "hitch up" if the errand is only a short one, and hence farmers are not up to walking. But one cannot live in the country, especially on a farm, without getting much exercise and development of the arms and the muscles of the upper part of body, while city lads get little or none. The medical reports of the war (Surgeon-General's Department) show that the farmers recovered from gunshot wounds quicker than those from big cities—their bodies being stronger and more generally developed.

In a recent paper, W. B. Platt, M.D., F.R.C.S. (English), declares that athletic exercise is essential to insure the health of city men. He finds these, as a rule, to be absolutely undeveloped above the waist. Their nervous system, he says, is injuriously affected by constant noise, and the brain and spinal cord jarred by continual treading on the stone and brick pavements. He says: "If there is one general physical difference between the country-bred and the city-bred man, it lies in the size and strength of the muscles of the shoulder and arm. It is almost impossible for a man to live in the country without using the arms far more than the city man. This use of the arms has, in both men and women, an important bearing on the general health, since it increases the capacity of the chest, and thereby the surface of living tissue where the blood is spread out in thin-walled vessels, through which the oxygen and carbonic acid easily pass in opposite directions, serving thus the double purpose of feeding the body more abundantly and of removing a constantly accumulating waste product."

The Human Conscience.

Whether or no man's conscience inclines him to the right, that is to say, to that which biblical and civil laws concede to be just, is an interesting ethical question, and one on both sides of which much may be said. It is a frequent confession of the great Kant that the conscience of man and the stars of heaven above all else excite awe within him, inferring, as he does, that the human conscience tends naturally toward the good, *i. e.*, what has been found to be, or at least appears to be, the best for society in general.

Mr. Herbert Spencer, in a recent paper, takes issue with Kant in this. He says that in Kant's day there were not so many books of travel as now, not so many expert investigators abroad, and consequently not so much was known of savage tribes or half-civilized peoples, but that now the conscience of man, as inductively known, has none of that universality of presence and unity of nature which Kant's saying tacitly assumes. He quotes Sir John Lubbock in support of his position ("Origin of Civilization," pp. 404, 405): "In fact, I believe that the lower races of men may be said to be deficient in the idea of right. . . . That there should be any races of men so deficient in moral feeling was altogether opposed to the preconceived ideas with which I commenced the study of savage life, and I have arrived at the conviction by slow degrees, and even with reluctance."

Mr. Spencer first quotes from the observations of travelers of known reliability to show that the savage conscience often holds as worthy of respect the expression of those qualities which those of the higher civilization are taught to abhor. Then he shows that the savage is sometimes found practicing all the virtues; and again, that so-called Christian peoples often thirst for blood, the stronger robbing the weak, the rich grinding the faces of the poor. In other words, he holds that the conscience is neither wholly good nor wholly bad, tending neither the one way nor the other, but adapting itself to circumstances and conditions. Kant believed the stellar universe to be evolved, and, from the meager evidence before him, attributed to the human conscience the same origin and the possession of a real nature.

The Home of the Great Auk.

That strange bird, the auk, who had an immense body with wings so puny they would not suffice to lift it from the ground, is now extinct, or rather it is believed to be, and all that remains to remind us of its one-time existence are its bones and some aged and ill-looking stuffed specimens or reproductions in the various museums; the same being in no two cases alike, neither as to shape, arrangement of plumage, nor general expression, and so it is we get only a confused idea of how the bird really looked. Funk Island, an exposed rock, 32 miles northeast of Cape Freels, Nova Scotia, was once famous as the resort of the great auk. Here these curious birds gathered in multitudes, and, in the breeding season, the weather being clear—a rare condition be it said—were often seen from the open sea, standing in serried ranks, like line after line of an army drawn up in battle array; tall, gaunt, silent.

Last summer, Mr. Frederick Lucas visited this island, a boat being sent with him and some companions from the Fish Commission's schooner Grampus; the weather being selected with care and arrangements made to camp, for the island can only be approached or quitted under most favorable conditions, so exposed it is, with a heavy surf on its seaward face and threatening rocks and angry currents to leeward. The whole island was found to be strewn with the bones of these birds; they had been slaughtered by the hundreds, perhaps by thousands, for they could neither fly nor fight, but only waddle slowly along wheresoever they might be driven. An inclosure was found, built of stones—a sort of shambles into which they were evidently driven to be despoiled of their feathers, though it is certain they were sometimes driven aboard boats over planks laid from gunwale to shore. Over a hundred sets of bones were gathered, the crania of each specimen showing signs of fracture, as if they had been beaten about the head with clubs.

Heating Buildings by Exhaust Steam.

At a recent meeting of the New England Railway Club, John A. Coleman said:

I have had a long experience in heating buildings by steam. When the matter of using exhaust steam was agitated, and most people were opposed to it, we took a number of mills, using then a 16 foot tubular boiler, and averaged a ton of coal a day. We heated the mill by using large pipes, having the circulation as straight as possible, open and free, with about two pounds back pressure on the engine, using no direct steam except in the morning in starting up and on Sundays. I had a similar experience in heating the building of the Providence Tool Company during the war. The building was 70 feet wide by more than 200 feet long, the rooms with 15 foot studs, and large windows, in an exposed situation, then heated by small pipes all around the walls, and using about a ton of coal a day for the boiler. In reconstructing, we took out the small pipe, cut it up into coils, which we placed in the center of the building, using a 6 inch pipe as the main artery through the building, and a 2 inch socket pipe for the condensed water, avoiding bends everywhere as much as possible. Result was that the building was overheated by using only exhaust steam, and about two pounds back pressure, and no extra coal was used for the fires. My idea in heating is to use large pipes, and carry a large body of steam to the point where you want to use it, and not strangle it on the way.

What the Result will be.

The *Milling World* thus soliloquizes on some of the wonderful projects of the period. When the Keely motor successfully motes, when a man serenely in atmosphere floats, when Yankees are brought to the eating of oats, when motion perpetual shall be achieved, when cyclone pulverizing is proved and believed, and when grinding pneumatic is else than conceived, we shall look to see some inventor successfully utilizing the power of Niagara River at its exit from Lake Erie. Meanwhile said inventors are wilting their collars in struggling to acquire the prize of $100,000 advertised to be awarded by the International Fair, Buffalo, N. Y.

PORT HURON, Mich., has a gas well that is six years old. The finders did not know what it was when they struck it. It was put down for oil, and, as the *Times* says, the objects for which the work was undertaken not having been reached, it was abandoned, and by some strange phase in this wide-awake community it is being forgotten. The site of the hole was originally a hollow basin. It is now a mound. The action of the gas through those years has forced over 500 tons of matter out of the bowels of the earth and is still at work. A power that might have been utilized in lighting and heating our city is thus running to waste in building a miniature hill.

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Straw Paper Making in Germany.

The process of making common yellow straw paper and straw pulp, although seemingly simple, requires exact knowledge and experience. The cheapness of the straw must not be exclusively considered, but the quality, as not only the quality of the paper, but the amount, depends upon it. Out of good, clean straw 80 per cent of paper or pulp can be obtained, while a poorer grade will yield scarcely 60 per cent. The *Papier Zeitung,* in a recent number, describes the various processes which different German makers use, and we give the article in condensed form: Old factories cook the straw, uncut, in wooden stationary vats without pressure. The straw is put in by layers, well packed down and a sufficient amount of 10-15 per cent lime added, the lime being previously slaked and cleaned. The vat is then filled with water, covered, and steam applied, penetrating from below, which will cause the mass to boil in two or three hours. The boiling lasts four or five hours, and then the mass is allowed to cool slowly. It is then put in a hollander and washed out before the beating rolls are lowered and the grinding done. In larger and newer factories the straw is cut into short lengths before cooking, and a cylindrical or round pressure kettle is used for the latter process. Lime in the form of milk of lime is used and a steam pressure of four or five atmospheres is applied. The duration of the cooking varies from two to ten hours. In many factories the cooked straw is passed through the grinder before being put in the hollander, which crushes the knots in the stalks, but the fibers are hurt so that the paper made by this process has never the firmness and tenacity of that made in the wooden vats. The grinder makes air-dried pulp too greasy, so that it warps and cannot be used in bookbinding and cartoon making. Straw has fine, weak fibers, and they should be kept as long as possible. The best machine to produce flat-lying, smooth, firm pulp is a hollander, built in its several parts properly for this work, and the miller should understand the business. The best stuff and firm, knot-free paper can then be made in double quantities with the least power. It is highly requisite that the paper be well pressed and dried on the cylinders of the press and that the "overcloth" be neither too dry nor too damp. A clean cloth does not adhere to the paper. Lime or clay is often taken to saturate the cloth, but in using clay or china clay the starchy paste often mixes with the pulp. There is nothing better to make thin paper from weak, fibrous stuffs, like straw and wood pulps, than the usual paper machine, because the paper leaves the drying cylinder with a dried surface and then it can be passed through the cutter by hand to the reeler or rolling machine. The side of the paper next the cylinder is smooth like glass, the reverse rough. The paper when very thin often is charged with electricity in the outer edges, so that it will not cut off both the circular knives, but this is afterward done by the cutting machine. The straw paper machine is not suitable for heavy paper of more than fifty grammes to the square meter. The long sieve machine is specially adapted, because the drying surface of the cylinder is greater. Much brown and green straw paper is used. The brown is made by adding, before the cooking of the straw, 6–10 per cent of sulphate of iron, which will make cheap wrapping papers, hard and tenacious. This sulphate of iron adds from 3 to 5 per cent to the weight of the paper and forms with the lime sulphate of calcium and oxide of iron or rust, and this latter does the coloring. Green straw paper is much used for wrapping of fire boxes. The best bleached fiber is used and the color obtained by 3 per cent of extract of logwood and 3 per cent of blue vitriol. The coloring matter is rather dear, but there is none better or cheaper. All these processes are those used in the making of the cheaper grades of straw paper, because lime cannot wholly free the fiber from incrusting and cementing matters. This is principally done by caustic soda, which gives a pure cellulose.—*Paper World.*

Electricity in the Reduction of Low Grade Ores.

The Utah Mining and Reduction Company, whose works are located at Bingham, ten miles south of Salt Lake City, are using the new "Meech process" in the reduction of their low grade and rebellious ores with success.

The ore is passed through a crusher and rolls, crushed to forty-mesh fine, thence into a disintegrating machine, four tons at a time, through a valve, with sufficient water and chemicals to treat the sulphur and refractory elements. Steam is then admitted to a pressure of one hundred pounds per square inch, and, at the same time, the mullers are revolved at about thirty revolutions per minute, generating electricity in such volume as to greatly assist in the decomposition of the ore.

This is continued for three hours. The ore is reduced to an impalpable powder, many times finer than is possible by other methods, and is thoroughly decomposed and desulphurized.

The water absorbs the chemicals, every atom of gold is made bright, and in condition for amalgamation. The pulp is now discharged into the amalgamator below, a revolving machine seven feet long and five feet in diameter, in which are copper plates placed lengthwise, and, by hydrostatic pressure, quicksilver is thoroughly pressed through the ore, by a "settler" of peculiar shape, having an electric copper wire broom to assist in gathering the fine amalgam before the tailings are discharged.

The cost of the treatment is from two to three dollars per ton, and, as the gold ores treated run from twelve to twenty dollars per ton, it leaves a handsome margin for the owners.

The ore veins are large, and thousands of tons, or enough to supply the mill for the next one hundred years, are already in sight.

By this process about ninety per cent of the gold is saved.

The works occupy about nine acres of land on the banks of the Jordan River, and consist of two main buildings, 32 × 64 and 24 × 34, one two-story boarding house, one blacksmith shop, two 35 horse power engines, one crusher, one roll, and other necessary appurtenances, are connected with the mines by the Denver & Rio Grande & Western Railway, and demonstrate in a practical manner the immense sums that can be realized from the treatment of low grade and refractory ore dumps, that have heretofore been considered absolutely worthless.

Poisons and their Antidotes.

The following brief summary of the most rational and simple antidotes to the commoner forms of poison in daily use by artists and artisans has been compiled for the *American Analyst* by Dr. Francis Wyatt, and it will be seen that he has suggested the most appropriate to be applied in any emergency, pending the arrival or in the total absence of a skilled medical practitioner.

POISONS.	ANTIDOTES.
1. Acid—Carbolic, sulphuric, nitric, muriatic, nitro-muriatic, creosote, iodine, phosphorus.	White of egg well beaten up with water. A teaspoonful of mustard flour in a cup of hot water. Very thick lime water—(in case of sulphuric, nitric, muriatic or nitro-muriatic acids).]
2. Chromic acid, chromates, all preparations or compounds of chromium, antimony, copper, mercury, or zinc.	Abundance of white of egg in water. A teaspoonful of mustard flour in water. Copious draughts of an infusion of salt herbs.
3. Ammonia, soda, potash, alkaline, silicates, and sulphates.	Strong vinegar and water. Large doses of oil. Large doses of milk.
4. Prussic acid and its salts, all cyanides and sulpho-cyanides, oil of bitter almonds, and nitro-benzine.	Continuous and heavy douches of ice cold water over the head and spinal column. Mustard plasters on the stomach and soles of the feet. Prevent sleep.
5. Ether petroleum, benzine, fruit essence, concentrated or absolute alcohol.	Plenty of mustard flour in large quantity of hot water. Cold water douches. Fresh air. Prevent sleep absolutely.
6. Compounds of baryta and lead.	A teaspoonful of mustard flour in warm water. Strong solutions of Epsom salts and Glauber's salts in cold water.
7. Compounds of arsenic.	A teaspoonful of mustard flour in warm water. A teaspoonful of dialyzed iron mixed with the same quantity of calcined magnesia every five minutes for one hour. Then plenty of oil, or milk, or some mucilaginous tea—say linseed.
8. Oxalic acid and its salts.	Very thick paste of lime and water by large spoonfuls at the time. After several of these, large draughts of lime water. Finally, 4 ounces castor oil.
9. Nitrate of silver.	Large doses of ordinary kitchen salt dissolved in water after which one teaspoonful of mustard flour in warm water.
10. Nitrous fumes of vapors, arising in vitriol or chemical works.	Frequent and small doses of strong acetic acid—the stronger the better.

Canadian Trepang.

In the waters surrounding the Atlantic provinces, a holothurian, *Pentacta frondosa*, Jaeger, very similar to the trepang of the Malay and Chinese coasts, is found in great abundance. It is called by our fishermen the "sea cucumber" or "sea pumpkin." A few experiments have been made on it as an article of food, and it has been pronounced good, with the flavor of lobster meat. Trepang, in the East, is prepared by dipping the live "sea cucumber" for two minutes in boiling water, then cutting open, then throwing into a second caldron of boiling water and mimosa bark. It is finally dried in the sun, and pressed for stowage. The market value has been quoted at from five to six dollars per hundred pounds; and the fisheries are considered of industrial importance. Will not some of our ingenious fishermen or fish dealers make a thorough test of our own "sea cucumber," and settle the question whether there is to be any Canadian trepang or not?—*Educational Review.*

Speed of Trains.

An examination of the *Official Guide* for June shows that the fastest trains now on the time tables are two on the Baltimore & Ohio, which are timed to run the 40 miles from Baltimore to Washington in 45 minutes, without stops, making the rate of speed 53·3 miles an hour. [It is stated, however, that these trains rarely succeed in making the trip in the time allowed.] No other train can be found which makes over 50 miles an hour, and the nearest approach to it is a train on the Pennsylvania, which runs from Jersey City to Philadelphia, making one stop, at an average speed of 48·3 miles an hour. On the opposition—the Bound Brook—line one train makes the distance from Jersey City to Philadelphia at the rate of 45·9 miles an hour, without allowance for the four stops. The quickest train between Philadelphia and Baltimore runs at the rate of 41·6 miles an hour.

The fastest long distance run is that of the Chicago Limited on the New York Central & Hudson River, which averages 41·6 miles an hour from New York to Albany, and 40·6 miles from Albany to Buffalo. The corresponding train on the Pennsylvania road runs at the rate of 38 miles an hour from Philadelphia to Pittsburg.

The trains which are timed to run over 40 miles an hour are thus found to be very few in number, and there are not many which are called upon to make more than 35 or indeed over 30 miles for any considerable distance. It must be remembered, however, that a train whose average speed is 40 miles an hour must make much faster time than that in parts of its run.

What is the slowest passenger train in the *Guide* is not easy to determine, but an "express" on a North Carolina line which takes 9 hours to run 100 miles—an average of 11·1 miles an hour—is a very promising candidate for the honor.—*Railroad and Engineering Journal.*

Columbia River Boat Railroad.

In view of the introduction into the United States Senate of a bill appropriating half a million dollars for the construction of this railroad, the *Northwestern Railroader* publishes a report made in 1885 by Major W. A. Jones, Corps of Engineers, U. S. A., giving estimates of the cost of boat transfer roads around the Dalles and Celilo Falls. The length of track for Celilo Falls is estimated at 4,500 feet, and the cost of track, car and machinery at $356,000. The estimated cost of the Dalles transfer is $662,000 for 9,000 feet of track. To make these portages available, it was estimated that $355,000 must be spent in rock excavation from the channel at other points, making a total expenditure of $1,373,000. The following is a brief description of the car and track proposed by Major Jones:

"The maximum grade of the track is 213·84 feet per mile. The summit is passed by a gentle curve quite within the limits of longitudinal flexure that will result from passing over the summit curve. The car is made up of cross girders supported by longitudinal built beams, which in turn are carried by the wheel axles, the whole suitably braced, and having sufficient iron introduced to prevent floating when completely submerged. It will be handled by cables from the stationary engine at the summit. It will have twenty-one wheels on each side, with independent axles, forty-two in all, running on a two-rail track 25 feet 6 inches wide. The maximum load on a single wheel will be about 17 tons. Length and width over all, 190 feet and 48 feet, respectively. For the present only a single line of track is proposed. Should the traffic develop a necessity for it, another can be laid alongside."

English Decisions Relating to Electric Light.

Justice Kekewich, London, has given judgment on the petition by Ferranti to declare the Gaulard & Gibbs patent on distribution by transformers bad, as not sufficiently describing the patent, and because Gaulard & Gibbs were not the first discoverers, and because the invention is not a proper subject for a patent. The judgment is given that the patent was bad, on the ground that it did not properly describe the process of distributing electricity. The judge ordered the patent to be annulled, and petitioners to have costs on the higher scale.

In the suit of the Edison and Swan Electric Light Company *vs.* Holland *et al.*, Justice Kay declares the Edison patent, No. 4,576, of 1879, invalid, second claim far too wide, the specification not describing a commercial lamp, and the directions are insufficient to make carbons. Mixing carbon with volatile powder is injurious, and the coating with a non-conducting and non-carbonizing substance is of no use. The second claim reads: "Combination of a carbon filament within a receiver made entirely of glass through which leading wires pass and from which receiver the air is exhausted, for the purpose set forth."

Judgment was given against the defendants as infringing the Cheesborough patent, and an injunction was issued with costs against defendants. The claim made by the Cheesborough patent is in respect to the process known as "flashing."

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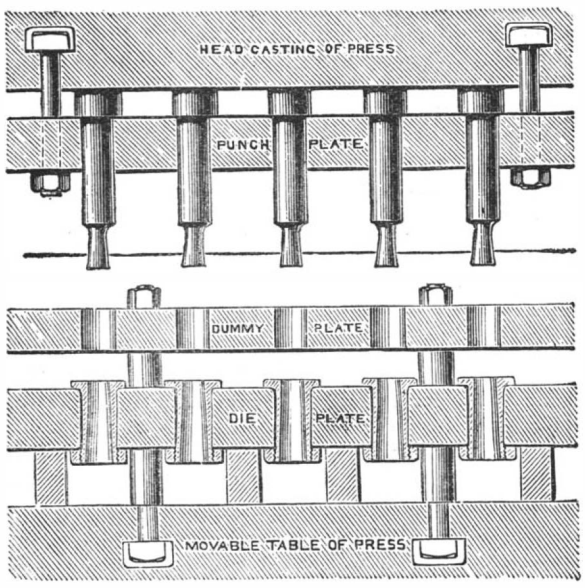
MULTIPLE PUNCHING AND FORGING PRESS.

The large press illustrated by the accompanying engravings is one recently constructed under Woodcock's patent for the Lancaster Wagon Company. It is capable of taking in plates of 12 feet in length by 4 feet wide, and punching at one stroke of the rams the whole of the holes required in such plates. It consists of three distinct presses, arranged so that they can be worked either separately, in couples, or all together. As shown in the engraving, which is from a photograph, two of the presses are coupled, and the third is working independently. When used for forging, each of the presses can be used independently. The peculiar features of the presses made under the invention are: That the punches and dies are regulated as to relative



position for any required pattern by a very simple arrangement of three pattern plates, which may be made of cast iron. The holes for the dies and punches in these plates being of the same diameter, they can be drilled through the three pattern plates at one operation. This may be readily gathered from the detail engraving annexed, which shows the moving press bed, the die plate, and the punch-carrying plate. This arrangement of plates and punches can be used with any pressure, and wherever repetition work requiring large quantities of punching has to be done, all plates and bars punched by the machine are perfectly interchangeable, and the system makes templates unnecessary, and avoids the cost of marking, the pattern plates being the templates. Guide stops are arranged in the pattern plates, so that the plate or bar to be operated upon cannot be wrongly placed in the press. The economy in the work done by this system of punching, when done on the large scale, is so great that the first cost of the press is rapidly repaid.—*The Engineer.*

Plant and Machinery of the Panama Canal.

At the recent Milwaukee meeting of the American Society of Civil Engineers, a paper on the above subject, by Mr. Williams, was read. At the early part of the work, the company owned the dredges, and they were run by the contractors. This was very unsatisfactory, however, as the contractors would use the company's plant to its full capacity, making no repairs, and when the machine broke down from any cause, however slight, it was side-tracked at once and a requisition made for another. Under present arrangements the machines are owned or leased by the contractors, and are worked night and day, but are overhauled and repaired on Sunday. They average about 100,000 cubic yards per month. One dredge made 237,000 cubic yards in a month, but it was in stuff that had slipped back into the channel and was very easily removed. At first, when operations were commenced at numerous places and only light work was encountered, a large amount of plant was needed, but now that the work is more difficult, and consequently slower, there is a quantity of valuable plant lying idle and useless, rapidly deteriorating, because there is not room for it to be put to work. The climate is deadly, consequently contractors try to make the largest amount of money in the shortest possible time, so as to be able to escape to a more healthy climate.

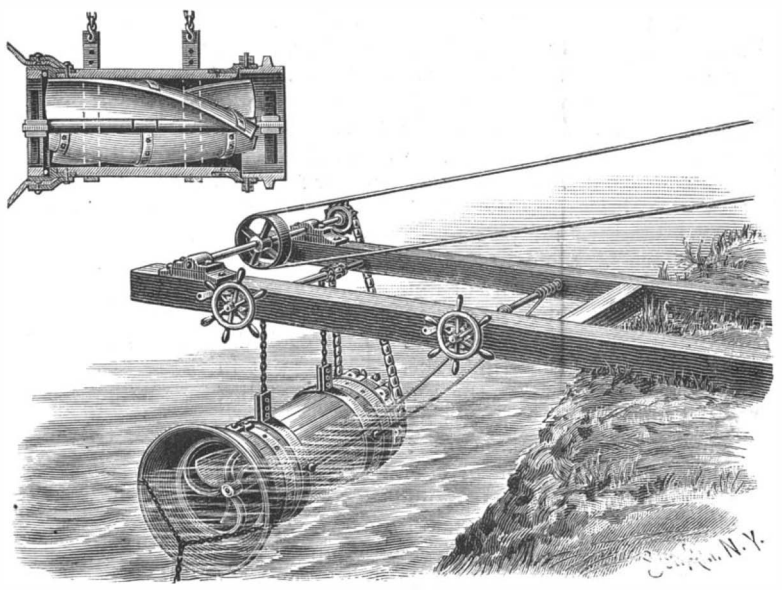
The dredges in use are of American, Scotch, French, and Belgian manufacture. The American dredging company has fine repair shops at Gatun, and keeps its plant in good condition, enabling it to do constant hard work. The Scotch dredges are self-propelling, and sailed out from Scotland, one of them across to the Atlantic end of the canal, the other going around Cape Horn to the Pacific end. The French dredges are sent out in sections and erected on the Isthmus. They cost about $100,000 delivered at Colon. This does not include their erection at Panama, which is very expensive. For the contractors' tracks a seventy pound rail is used, with a height exceeding the base, and the locomotives overturn the rails, drawing the spikes. For these tracks a forty pound or a fifty pound rail, with a base equal to the height, would have been sufficient. Mr. Williams hopes later to give a detailed paper on the dredging plant of the canal.

American Tin.

It is tolerably well ascertained that the Black Hills region, in Dakota, possesses a number of deposits of tin ore of sufficient richness and quantity to assure an abundant supply of this metal when they shall be judiciously developed.

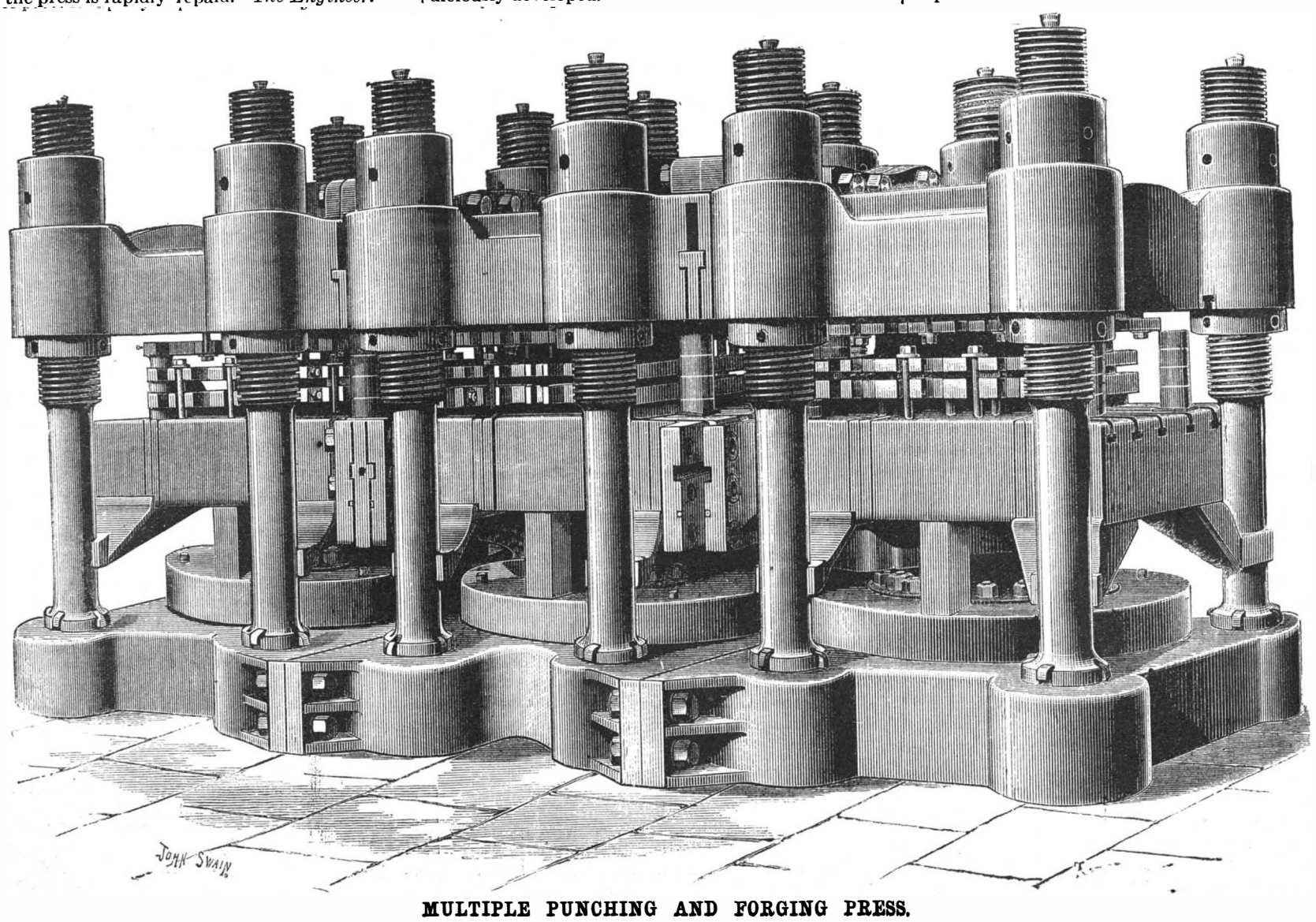
AN IMPROVED CURRENT MOTOR.

A current motor readily adjustable to high or low stages of the water, and also laterally adjustable, to take advantage of inshore and offshore currents to regulate the speed of machinery driven by it, has been patented by Mr. Michael McCarty, of Montrose, Col., and is illustrated herewith, the small figure showing a longitudinal sectional elevation. The current wheel is suspended from a framework by straps and chains, the latter connected to a shaft with a hand wheel journaled on the frame, the chains being wound or unwound to raise or lower the wheel. Ropes or chains attached to the casing of the wheel, on the side next the bank, lead to a similar shaft with hand wheel journaled on the frame farther inward, by which the current wheel may



McCARTY'S CURRENT MOTOR.

be drawn toward the bank. An anchoring rope is attached to the outer edge of the mouthpiece at the up-stream end of the wheel casing, to hold the wheel steady in the water against the force of the current. The current wheel consists of a spirally-bladed shaft journaled in the casing, skeleton wheels mounted on each end of the shaft revolving freely against anti-friction bearings within metal bands fixed to the up-stream and down-stream ends of the casing. The skeleton wheel fixed to the down-stream end of the shaft forms the driving wheel, having peripheral teeth engaged by the links of a driving chain passing over a chain wheel fixed to a shaft journaled on the frame above, and carrying a wheel or pulley, from which a driving belt leads to the machinery (not shown) which it is desired to operate upon the bank of the stream. When this wheel is to be used in a swiftly running current, the flaring mouthpiece, which gathers water to the wheel casing, may be dispensed with.



MULTIPLE PUNCHING AND FORGING PRESS.

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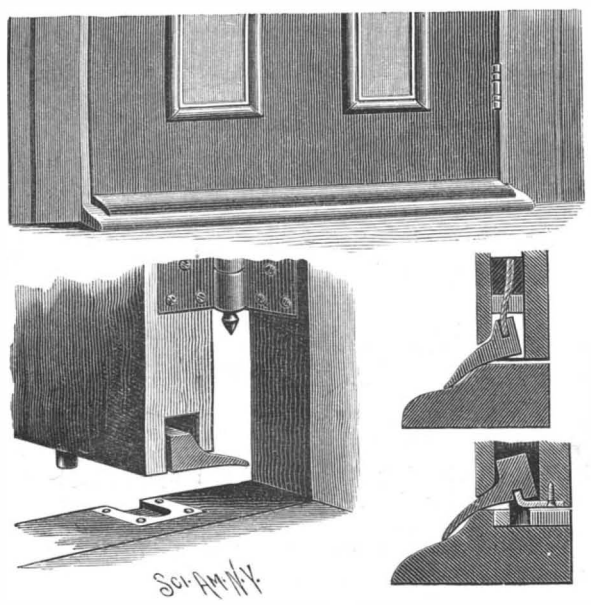
AN IMPROVED WEATHER STRIP.

A weather strip adapted to be easily closed against a threshold, but tightly held there when the door is shut, and which will readily clear the threshold when the door is opened, is illustrated herewith, and has been patented by Mr. Robert C. Redman, of Salem, Oregon. The weather strip is formed with a vertical portion projecting into a recess in the lower edge of the door, and rests on lugs secured by screws in recesses in the bottom of the door. To hold the weather strip up when the door is open, a spring is secured to a block fastened in the upper part of the recess in the lower edge of the door, and projecting into a slot in the vertical portion of the strip. Upon the lower side of the weather strip, near the hinged side of the door, is

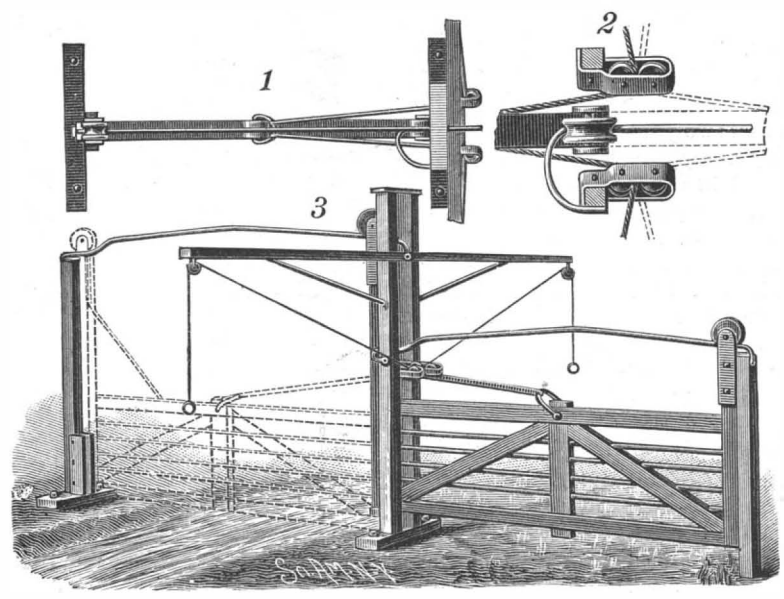


REDMAN'S WEATHER STRIP.

a pin which engages a slotted plate on the threshold, when the door is closed, thereby drawing the weather strip down close over the threshold, as shown in detail in the small views, the slot of the plate being so cut out that the act of closing the door causes the pin, in bearing against the end wall of the slot, to tilt the weather strip so that its outer edge comes in contact with the threshold. The spring, which is brought under tension in closing the door, reacts as the door is opened, bringing the weather strip back so that it will readily clear the threshold.

AN IMPROVED FARM GATE.

A gate which may be readily opened and closed by a person in a vehicle or on horseback, by simply pulling cords at the roadside, has been patented by Mr. Martin L. Baker, of Wilton Junction, Iowa, and is illustrated herewith, Figs. 1 and 2 showing plan views of the gate and main gate post, and Fig. 3 representing the gate closed in dotted lines and open in full lines. The main post consists of two uprights framed into a sill timber, separated sufficiently to allow the gate to run between them, and connected at their tops by a head piece. The end uprights of the gate, one of which is higher than the other, are fitted with rollers adapted to travel upon metal tracks, one track extending over the roadway to a post on its other side, and being higher than another track which extends out to a post at right angles to the roadway in the opposite direction. A bar is fastened to the main post, ranging lengthwise of the



BAKER'S FARM GATE.

roadway, to which gate-opening cords are attached, their pendent ends hanging in convenient reach of any one approaching the gate from either direction. The cords pass between pairs of guide pulleys journaled in strap bearings fixed to the uprights of the main gate post, and their inner ends are attached to a stirrup or bail pivotally connected to the upper central portion of the gate. By pulling on one of these cords, when the gate is in either closed or open position, the gate rollers are caused to ride up to and over the highest parts of the tracks, and will then run down the incline upon the opposite side until the upright on the end of the gate stops against the post. Depressions at the ends of the tracks, in which the rollers rest, prevent the opening of the gate, when closed, by stock rubbing against it, and only a short, sharp pull on the cords is necessary to readily open or close the gate.

AN IMPROVED MECHANICAL MOVEMENT.

An invention affording improved means of converting reciprocating or oscillating motion into rotary motion is illustrated herewith, and has been patented by Mr. Benjamin F. Andrews, of Myers, Mo. The apparatus comprises a shaft suitably supported so that it may be revolved, a slotted pitman, in the slots of which are racks, and an oscillating lever connected with the pitman. On the shaft are loosely journaled toothed wheels fitting close together at their inner faces, and rabbeted on their inner sides next their periphery, the two rabbets forming a way for rails or guide plates on the slotted pitman, the arrangement being such that one rack meshes one wheel to revolve it in one direction, while the other rack will revolve the other wheel in the opposite direction, the wheels being so clutched to the shaft that they will slip on it when turned in one direction and grip it when turned the other way, one wheel turning the shaft as the pitman is moved forward and the other as it is retracted. In connection with these wheels are also provided teeth within sockets on their outer sides for engagement by pawls, of which there are a number in recessed pawl carriers or supports, so arranged that by adjusting these pawls the apparatus may be operated to turn the shaft in one direction or quickly reverse it to the other. A sectional view showing the arrangement of the pawls and pawl trippers is given in Figs. 2 and 3, the trippers being either turned directly by hand or by means of a lever pivoted to the top of the frame. The lever reciprocating the pitman is supported to move at its axial center in a frame having rack teeth in opposite walls, the lever having a toothed segment meshing one rack and a toothed roller meshing the other rack. The lever has several openings or sockets, and a guide frame with notches registering with the sockets, serving as guides in stopping the connecting block, which is movable within the guide frame. By adjusting the connecting block, and with it the pitman, along the lever, to and from the center of motion, the length of stroke of the pitman may be varied. To relieve any shock or jar in the operation of the lever, and ease the action of the machine, its supporting frame is provided with spring plate cushions at its opposite ends.

Clean Your Grain.

Weevil, cockle, smut, husks, and fuzz and all other matter that does not make flour should be kept out of the flour as perfectly as possible. Clean, clean, clean, thoroughly, tirelessly, and systematically. The more you clean the grain, the more fine flour of the best quality you can make. Every particle of foreign substance that finds its way into the flour destroys something of its desirableness, weakening it, discoloring it, and making it less like what it should be. Clean always and everywhere. Let cleaning of the grain be a hobby with you. It will pay.—*Milling World.*

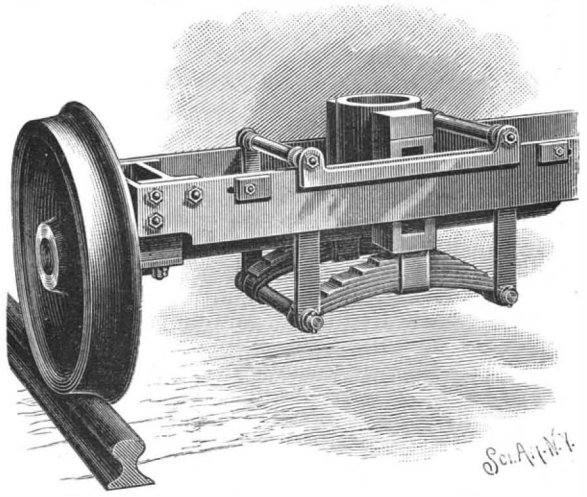
AN IMPROVED FLUE CLEANER.

A flue cleaner having adjustable cleaning blades, readily adapting it for use in flues of different diameters, has been patented by Mr. James Newmon, of Haw Ridge, Alabama, and is illustrated herewith, Fig. 3 showing a sectional view, and Figs. 1 and 2 representing side and end views. The cleaner head has a flat-faced flange in which are a number of slots, the head having a central bore threaded at each end, the thread at the outer end being arranged for engagement with a set screw or bolt, whose shank passes through a clamping plate. Between the clamping plate and the flange of the head are placed segmental cleaning blades having peripheral serrated edges, each of the blades having a cross piece which rides in slots of the flange of the head, and in other slots in the clamping plate, whereby each blade may be readily moved toward or from the screw shank. The handle is threaded at one end for engagement with the thread in the bore of the unflanged end of the head, and upon the handle is mounted a gauge for preventing the head from being forced in too far.

THE man who is constantly absorbing information never poses as a "know it all," but he is usually a person who can impart very many valuable and practical ideas.

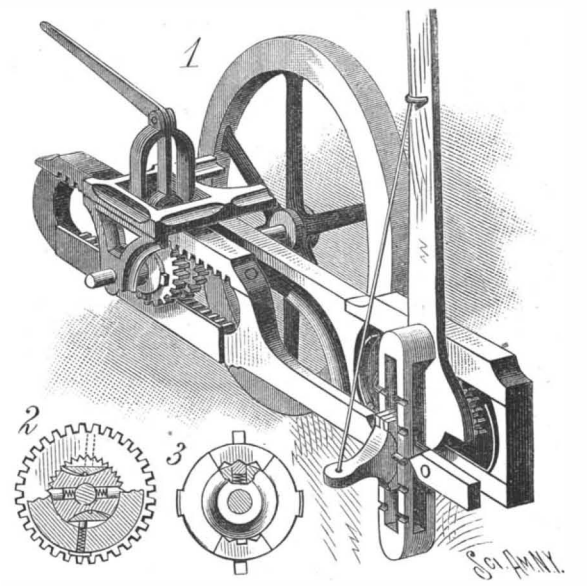
IMPROVED TRUCK FOR LOCOMOTIVES AND STREET MOTORS.

A truck of simple construction, which provides for the swinging of the car body in passing curves, is illus-



PACKER'S LOCOMOTIVE TRUCK.

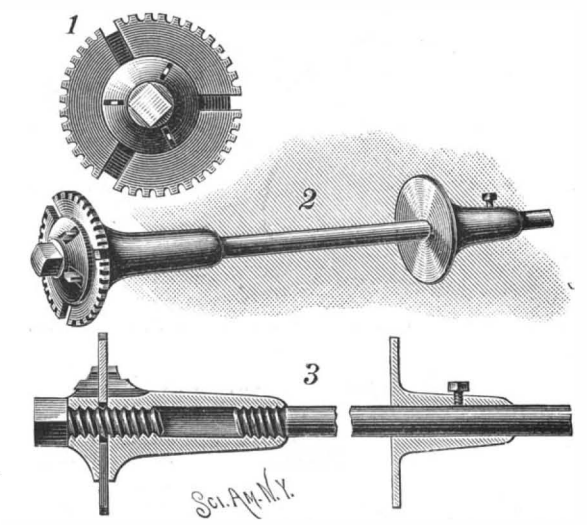
trated herewith and has been patented by Mr. Alonzo C. Packer, of No. 118 Forty-fifth Street, Pittsburg, Pa. Upon side rails of the truck body are arranged crossbars or shafts, upon which are mounted small wheels or rollers that bear upon the upper faces of the rails, and just outside these rollers are connecting links extending from shaft to shaft. Within the rails are mounted links supported by the crossbars, these links supporting springs upon which is a center bearing plate to receive the king pin of the body center plate. To each of the side rails are connected stop blocks, the bolts by which the blocks are secured to the rails being so placed as to allow the throw of the connecting links and parts controlled thereby to be varied, and providing for the swinging of the car body upon the truck,



ANDREWS' MECHANICAL MOVEMENT

the range of motion being partially checked by the stop blocks. Trucks of this construction are now used on street car motors in Birmingham, Ala., the motors having 12 in. by 18 in. cylinders, driving wheels of 40 in. diameter, and the back truck wheels 24 in., with rigid wheel base of 5 ft. 9 in. These motors are said to pass easily around curves of 34 ft. radius, and to give entire satisfaction.

THE 2,000 horse power engine of the Warren Manufacturing Company, R. I., drives all the machinery of the works from a rope pulley 32 feet diameter and 9 feet 3 inches face, carrying 43 ropes 1¾ inches diameter, instead of a belt. One advantage this system possesses over belts is that several shafts can be driven at different speeds from the same driving pulley, thus saving much countershafting.



NEWMON'S FLUE CLEANER.

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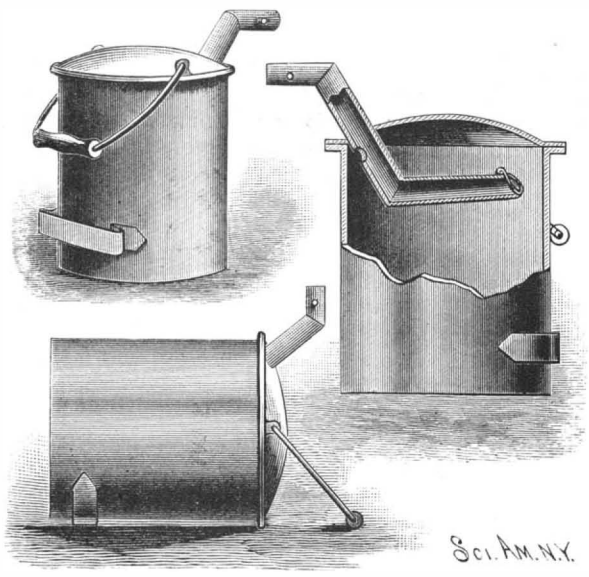
AN IMPROVED OIL CAN.

An oil can designed to automatically stop the flow of oil when the lamp being supplied from the can is practically filled, is illustrated herewith, and has been patented by Mr. George H. Coursen, of 1017 North Calvert St., Baltimore, Md. The can may be of any ordinary construction, but preferably should have a hermetically sealed top and bottom, the body having a strap at-

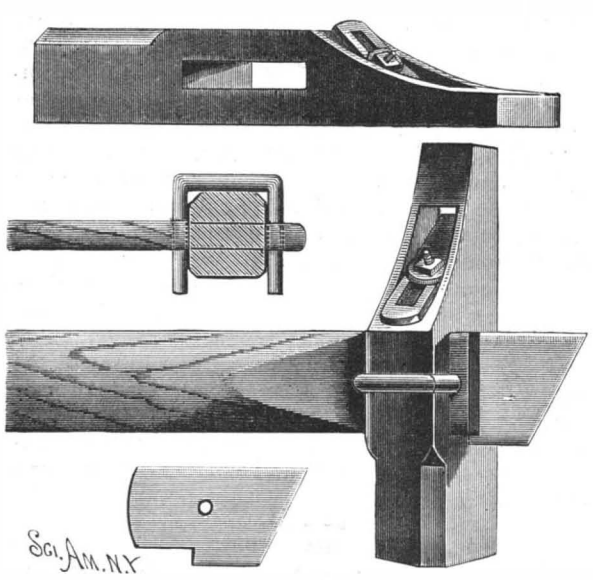


COURSEN'S OIL CAN.

tached to the rear at or near the base, which, besides serving as a hand-hold, makes a suitable rest for retaining the can in horizontal position, as shown in one of the figures, this being the preferred position for filling such a can through the spout. The tubular spout is preferably of metal, about half an inch in diameter, and extends within the can as shown, its inner extremity being designed to terminate as much as possible in the air space, and this end being cut obliquely and having a hinged whistle resting normally against its upper surface. This inner section of the spout has an aperture on its under side, near the top of the can, the area ofthe aperture being about one-third that of the spout. In filling a lamp, the spout is inserted until stops or pins near the end of the spout rest on the rim, when, upon tilting the can, the oil flows through the small aperture on the under side of the tube, leaving enough space in the tube to permit the air in the lamp to pass back into the can, thus producing a sound through the whistle on the inner end of the tube. When the oil in the lamp has risen to the end of the spout, cutting off the air supply, the oil will cease to flow and the whistling will be discontinued, thereby apprising the operator that the lamp is full.

A COMBINED SHINGLING HAMMER AND PLANE.

A convenient and inexpensive combination tool for capenters and builders, which may be used either as a hammer, plane, or hatchet, and is designed mainly for use in shingling, has been patented by Dr. William S. Robertson, of New Germany, N. S., Canada, and is illustrated herewith. The narrower end of the hammer head has a flaring aperture adapted to receive a plane iron, the narrow opening for which is in a side of the hammer having a flat face from one end to the other. To guide the plane along the edge of a shingle,



ROBERTSON'S SHINGLING HAMMER AND PLANE.

a staple formed of a wire bent twice at right angles is inserted in holes formed in the handle on opposite sides of the hammer head, this guide being removed when it is desired to use the plane in the ordinary way. The wedge inserted in the end of the hammer handle, to bind it in place in the eye of the hammer, is of steel, and has two beveled and sharpened edges, for use in cutting and scoring, the wedge being also apertured to receive one arm of the guide staple.

For further information relative to this invention, address Mr. E. Davison, Jr., Bridgewater, N. S., Canada.

Ice on Mars.

At a recent meeting of the Academy of Sciences, Paris, M. Janssen, president, in the chair, observations were made on the canals of the planet Mars, by M. Fizeau. The various circumstances connected with these appearances, as lately described by MM. Perrotin and Schiaparelli, suggest a strong analogy with certain phenomena of glaciation—parallel ridges, crevasses, rectilinear fissures, often of great length and at various angles—observed in the regions of large glaciers in Switzerland and especially in Greenland. This leads to the hypothesis of a vast development of glaciation on the surface of Mars, where, the seasons being relatively longer and the temperature much lower, the conditions must also be more favorable than on the earth for these manifestations. The reading of the paper was followed by some remarks by M. J. Janssen, who gave a guarded assent to M. Fizeau's "very ingenious and very beautiful" theory.

Primary Batteries of Light Weight.

In a recent communication to the Societe d'Encouragement, M. Renard describes a form of primary battery devised by him to provide the power required for a navigable balloon. None of the batteries or accumulators in existence at the time his experiments were made was sufficiently light, and a new one had therefore to be devised. After many experiments he found that by making use of a mixture of hydrochloric and chromic acids as exciting fluids, a cell giving very good results was obtained. The liquid in question is not very stable, as under certain conditions chlorine gas is liberated, but with care it can be kept for several days. The positive electrode of the cell is formed from a plate of platinized silver, carbon being unsuitable owing to its low conductivity, as a very high current density must be employed if the weight of the elements is to be kept down. The negative electrode is formed from a very thin plate of non-amalgamated zinc, which is not dissolved on open circuit, provided that the CrO_3 in the solution does not fall below 1-70 of the equivalent for the HCl present. The cells are tube shaped, made from either glass or ebonite, the diameter of the tube being about 1-10 its length. The normal potential of the cell is 1·2 volts, and from cells weighing but 33 lb. 200 to 250 watts per second have been obtained during two hours and a quarter.

Wages in Scotland.

The *Paper Trade Review* gives an official statement of the wages paid in Scotch paper factories in 1883, which are indeed higher than those paid upon the average in Germany, but not so much higher as commonly supposed:

Paper machine operator for 57 to 72 hours.....	$5.25	to	$7.75
Young men helpers of operator for 57 to 72 hours...	2.25	to	4.00
Calender operator and sorter for 57 to 64 hours.	5.00	to	5.50
Sorters (girls), for 57 to 64 hours.....	1.12½	to	1.50
Sorters (women), for 57 to 64 hours.....	2.75	to	2.87½
Rag sorters (girls and women), for 57 to 64 hours.....	2.25	to	2.50
Machinists, for 57 to 64 hours.....	6.50	to	7.50
Firemen, for 57 to 64 hours.....	5.00	to	6.25
Day laborers, for 57 to 64 hours...	4.00	to	4.75
Men also earned (daily) on an average.....			75
Operatives also earned (daily) on an average...	1.00	to	1.25
Women also earned (daily) on an average,.....	18¾	to	37½
And in exceptional cases as high as....			50

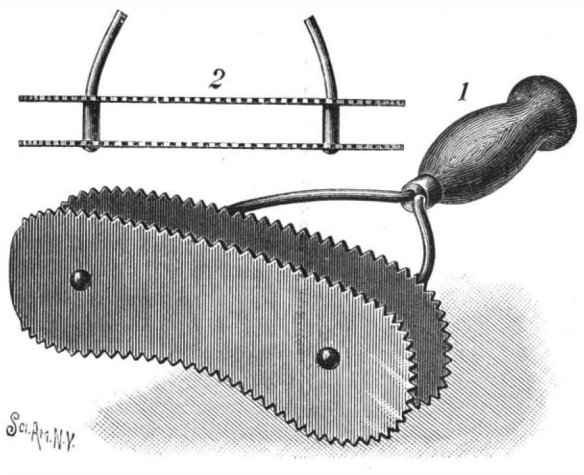
Valuable Insulating Material.

A very valuable insulating material, described in the *Chronique Industrielle*, has just been produced. It is composed of one part Greek pitch and two parts burnt plaster, by weight, the latter being pure gypsum raised to a high temperature and plunged in water. This mixture when hot is homogeneous, viscous paste, and can be applied by a brush or cast in moulds. It is amber colored, and possesses the insulating properties of ebonite, and can be turned and polished. Its advantage is its endurance of great heat and moisture without injuring its insulating properties.

THE EGG SHELL METHOD OF PRESERVING FOOD, particularly meat, without cans, recently patented by Dr. Henry Salzer, of Baltimore, Md., consists essentially in inclosing the meat or other article in an expansible wrapper, such as animal membrane, and subjecting it to a sterilizing steam heat long enough to kill all germs. It is then immersed in melted vaseline, which forms a permanent coating on hardening, and finally inclosed in a protective wrapper, such as gauze coated with plaster of Paris, or the coating of plaster of Paris may be applied directly on the expansible envelope, and the article then placed in a bath of vaseline or other plastic substance, the package thus prepared being wrapped in paper or tinfoil. This method of preservation necessarily avoids any contamination of the articles by metals or acids, and will enable housekeepers to keep all delicacies, such as game, tender parts of meat, etc.

AN IMPROVED CURRY COMB.

A curry comb which is light and strong, and not liable to accumulate dust or hair, has been patented by Mr. George W. Blythe, of Ashland, Mo., and is illustrated herewith. It is made with two smooth-faced plates, preferably of tempered steel, having concave and convex serrated working edges, and one square end to serve as a striking surface while cleaning the comb. The plates are mounted upon the handle wires, and held in fixed position parallel with each other, by bringing one of the plates against shoulders on the wires, placing thimbles upon the wires between the



BLYTHE'S CURRY COMB.

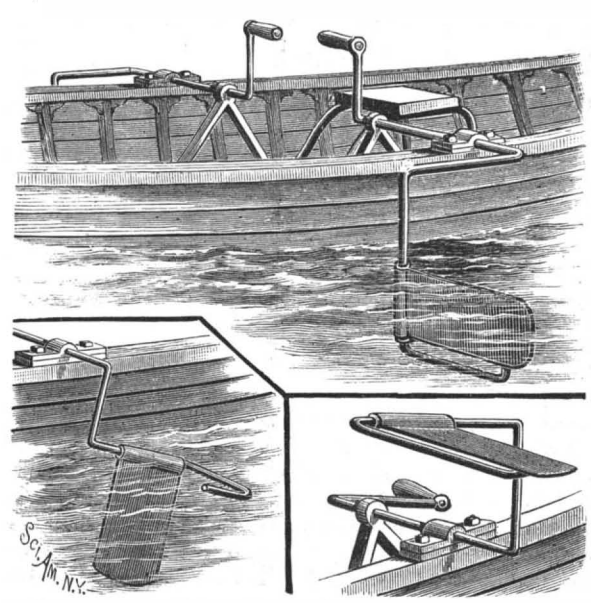
plates, and riveting the wires down upon the outer face of the outer plate.

Glass Balls for Refilling Wine Casks.

Wines which contain less than about 15 per cent of alcohol cannot be kept in casks, unless the latter are kept full, and protected from the air. When a portion of the contents of a cask is withdrawn, the vintner fills it up again from reserved stock until the particular brand gives out. He then used to, and still does, resort to the practice of putting pebbles into the cask to occupy the volume of the displaced wine. But even with the best of care, some ferruginous or otherwise impure pebbles are apt to get in, which may injure the flavor of the wine. For this reason, glass balls are now being used by many in place of the pebbles.

AN IMPROVED PROPELLER FOR PLEASURE BOATS.

A device whereby an inexperienced person may safely and conveniently propel a boat through the water is illustrated herewith, and has been patented by Mr. Israel G. Howell, of Hopewell, N. J. Vertical standards are secured to the bottom of the boat, at each side of a frame in which a seat is supported, and in these standards, and in bearings on the gunwales of the boat, are journaled crank shafts, the handles of which terminate at each side of the seat. Upon the outer pendent arm of each shaft is hinged a blade, the unattached extremity of the blade being supported by the upwardly curved outer extremity of the shaft, as best shown in the small figures. With this construction, as the operator reciprocates the shafts by means of the handles, the blade is alternately pushed against the water and easily drawn through it, the blade in the back stroke assuming a position parallel with the side of the boat. When the blades are not in use, they may be elevated above the gunwale and so held by pressing downward



HOWELL'S VIBRATING PROPELLER.

the inner arms of the shafts to engagement with the floor of the boat.

A TUNNEL near Samos, which dates from about 530 B. C., has recently been explored by a German expedition. It was constructed as a water conduit, and has been driven through limestone rock to a length of 1,235 feet.

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The Mysteries of Iron and Steel.

Mr. Hadfield details the remarkable results yielded by manganese steel under severe tests, and a series of tables appended to his paper certainly show singular extremes under tensile and other strains. In one case as much as 190·62 per cent elongation was obtained, the 8 inch piece of material being drawn out cold 7·6 inches and being reduced in area 91·07 per cent. Under torsional tests the results were equally good. In concluding his first paper, Mr. Hadfield remarks:

"A varied experience in the manufacture of steel has taught the author how limited is the knowledge of this branch of science, and how little room there is for dogmatic assertion." Mr. Hadfield's second paper begins with the query, "What is steel?" He remarks that the definition of the word "steel" is becoming very difficult, and some decision must be taken before long upon its exact meaning. Hitherto the term has been applied to malleable alloys of mixtures of iron (Fe) and carbon (C), but there are also other compounds of a steely nature, which do not come within that category. In a work recently published by M. Bresson, steel is defined as "a particular state of iron produced by its union with bodies the nature of which can vary. There are three classes. First, steels composed of iron and carbon; second, those of iron, carbon, and a third body; third, those formed of iron and another body which is not carbon."

Mr. Hadfield accepts the accuracy of this definition, and proceeds to discuss certain leading properties of manganese steel. Water causes that material to become stiffer, but in an entirely different way to hardened carbon steel. Mr. Hadfield, therefore, terms the process "water toughening." Under it the tensile strength of manganese steel rises from 40 to 60 and in some cases over 70 tons per square inch, and there is a considerable increase of ductility or elongation, whereas in all carbon steel (except in "ingot iron") the opposite effect is produced. In two specimens to which Mr. Hadfield alludes, the tensile strength of the bar as received from the forge was only 36 tons per square inch, with 1·56 per cent elongation. After water toughening it rose to the extraordinary amount of 67 tons, with 44·44 per cent elongation, and even then the specimen was not fractured. The same result occurs if the steel be dipped when at a welding heat, although the carbon may be 1 per cent or even more. Mr. Hadfield says that after a large number of tests with regard to the action of heat and sudden cooling upon the material, it is found that the higher the heat and the more sudden and rapid the cooling, the higher is the breaking load and the greater the elongation. This property should be of great utility for certain purposes. Oil does not give such good results as water or sulphuric acid. Mr. Hadfield confesses that it is not easy to understand the action of the water quenching process. Chernoff explains that the effect of oil tempering on ordinary steel is to produce a metal of fine grain, but in manganese steel the change, if any, is rather in the direction of a more open than a closer grain. Mr. Hadfield is puzzled by a piece of the cast toughened 9 per cent manganese steel, at which percentage the crystallization is very peculiar, and shows that a broken ingot reheated to a yellow heat and water-quenched, although greatly toughened thereby, showed no structural changes whatever. He draws special attention to a specimen with 1·85 per cent carbon and 9·42 per cent manganese, which was heated highly and plunged into cold water, yet was not water-cracked, and slightly softer. He argues, therefore, that carbon seems to be entirely deprived of its usual hardening properties in this material. As to crystallization, Mr. Hadfield points out the higher the percentage of manganese, the less marked becomes the crystallization, and he is evidently of opinion that the material is not merely a mechanical mixture of the different elements, but a definite alloy. The manganese steel possesses the curious property of being almost entirely non-magnetic. When there is 20 per cent of manganese, a magnet produces virtually no effect, no matter whether the material is cast, forged, quenched, etc. This fact is a strong argument for the alloy theory, and shows that there is at command a material of great strength exactly suited for certain parts of electrical machines and appliances. The material is also a bad conductor of heat, which is another property capable of being freely utilized.

Mr. Hadfield devotes a special section as to the influence of carbon and manganese upon iron, and goes into the subject very carefully and thoroughly. As showing the curious behavior of the maganese steel, he says: "It would be impossible to chip any of the material containing 4 per cent, while a cast bar 2½ inches square, containing 9·5 per cent of manganese, is indented by a hammer or chisel, will bend 2 inches before fracture, and, though exceedingly tough, is of a much softer nature." It follows that manganese cannot be the sole cause of the hardness, otherwise the more manganese, the greater would be the hardness. Mr. Hadfield cautiously remarks, as to the hardness of steel having hitherto been attributed entirely to carbon and other minor elements, "May it not be possible that the part played by the iron is equally, if not more, important, perhaps owing to some change of form of the iron itself hitherto not suspected?" In support of this supposition he mentions that bronzes, said to contain high percentages of manganese, are easily machined, and only possess a tensile strength of about 30 tons, whereas the tensile strength of manganese steel varies from 50 to 70 tons. On the face of it there would seem to be considerable doubt as to the real cause of the hardening of steel, seeing that in the presence of high percentages of manganese steel is softened instead of being hardened when dipped in water. Mr. Hadfield calls special attention to the fact that no further advantage is gained in ordinary steel by adding more than 1·5 to 1·75 per cent of carbon, amounts above this not producing any greater degree of hardness. The analyses of the majority of the Sheffield carbon tool steels show not more than 1¼ to 1½ per cent. If carbon itself were the sole cause of hardness, it would be imagined that 2 to 2·5 per cent should give greater hardness than 1·25 per cent, but in practice this is not found to be so. In view of this fact the question of crystallization or structure becomes of great importance, and obviously deserves further investigation. Professor Barrett notes another point of difference, in the shape of the fact that manganese steel when cooling does not give any "after-glow." A Sheffield rolling mill also reports that in rolling 800 feet in one length of this wire, the finer it became the more it seemed to retain the heat—indeed, it appeared to gather heat in the process. In concluding his very interesting paper Mr. Hadfield urges that some understanding should be come to as to the meaning of the term "steel." In the past the word has sufficed for an alloy or compound of iron and carbon, but as the latter is now replaced by other elements, such as manganese, chromium, silicon, or tungsten, a newer and clearer definition is required.—*The Ironmonger.*

The Storage of Life.

Dr. B. W. Richardson has often given evidence of his power of clothing familiar facts in attractive and novel garb, and of arresting attention while forcing home some well worn truths. This faculty he drew upon largely in his interesting address at the anniversary meeting of the Sanitary Institute of Great Britain, when he chose as his subject the "Storage of Life as a Sanitary Study." The conditions favoring the storage of life he dealt with under the headings of hereditary qualification, the virtue of continence, maintenance of balance of bodily functions, perfect temperance, and purity from implanted or acquired diseases. While urging the importance of maintaining the balance of the working organs of the body as a means of keeping up the storage of life, the lecturer spoke yet more emphatically upon what he termed "all-round temperance"—temperance in speech, action, thought, as well as in eating and drinking. Everything that quickened the action of the heart he regarded as a stimulant, taxing and reducing the storage of life. Necessarily the work of the sanitarian called for appreciative remark toward the close of the lecture, the prevention of "damaging diseases" promoting the storage of life. After all, in spite of the interest of the lecture, the moral is somewhat trite.

The advantages of a favorable family history, the disadvantages of acquired diseases, the influence of personal habits of restraint—all these have long been granted. The individual may toil and strive, but he is still largely at the mercy of his neighbor, whose erratic proceedings may greatly upset all the foresight of storage. While all admit the value of personal attention to sanitary and physiological laws, most people will wish for greater powers of sanitary control over the actions of their neighbors.—*Lancet.*

Grasshopper Traps.

There are three principal methods of destroying the insects. Where the land had been plowed for wheat none hatched out, as inverting the soil destroyed the eggs, and no hoppers were found in the fields of growing wheat. But from adjoining fields, especially those where wheat was grown last year and then abandoned without plowing, they came in armies, sweeping the fields before them. In traveling this way a line of march is formed before which every green thing disappears. When Dr. Lugger left, some of the fields were eaten into several rods. The method adopted prior to the arrival of kerosene and tar was to dig a ditch two feet deep and two feet wide just in advance of the approaching host. A few inches of straw is then placed in the bottom, and the locusts are driven into it by walking slowly along behind them. They cannot jump out and are burned; or, if straw is not to be had, they are killed by drawing a log through the ditch. The tar is used by placing in a shallow sheet iron pan two feet wide and eight feet long, with a wide board fastened to one side.

This is drawn sidewise across the field, the hoppers jumping against the board and falling into the tar, where they perish. But the handier, more rapid, and most complete method is to use kerosene on canvas, against which the pests jump. Strong muslin or canvas, a yard wide and fifteen feet long, is stretched on a frame and carried on a sled-like arrangement pulled by a team. The canvas slants back, and is constantly saturated with kerosene. Every one that hops against this and touches his body to the oil dies instantly. One barrel of kerosene will go over about 120 acres, and will kill 200 bushels or more. Each farmer is given one barrel of oil, and promises to use it only for destroying insects.—*Minneapolis Exchange.*

Naval Balloons.

An experiment has been made at Toulon for the employment of captive balloons on board ship. The floating battery Implacable, which had been fitted up with the necessary apparatus for producing gas, and provided with balloons and necessary gear, was towed out of harbor into the roadstead and moored opposite the Mourillon dry docks for the trial. Under the directions of Lieut. Serpette, and in the presence of the port naval authorities and officers of the evolutionary squadron in the roads, a balloon of the cubic capacity of 310 meters (about 1,010 feet) was fully inflated at night in one hour and a half. The process of producing the gas was effected by means of some thirty or more metal vessels of alembic form, ranged side by side on the upper deck, and each containing a recipient charged with zinc filings and hydrate of lime mixed. The application of heat sufficed to evolve hydrogen vapor in adequate volume to fill the balloon within the time mentioned, and with this operation the experiment concluded, as no ascent was attempted upon the occasion, and the balloon was kept attached to the Implacable.

It transpired that the introduction of the aerial machine into the French naval service was accounted an innovation of special importance, and would be utilized in directing electric glares in the darkness toward vessels upon the surface of the waters, and discovering the presence or movements of a hostile fleet at various determined distances. The initiatory trials were deemed highly satisfactory and repeated the next morning upon a more extended scale, when a silken balloon of the measurement of 260 meters (932 cubic feet) was inflated by gas produced by other chemical transformations, but in a more expeditious manner. When all was ready for the ascent, Lieut. Serpette and one of his specially trained company of seamen took their places in a small car, which also contained a series of instruments and appliances for scientific research as well as a telephone apparatus, with its wire rolled around the winding cable.

The ascent was effected under the most favorable conditions, a perfect calm prevailing at the time, and the subsequent experiments in the air were consequently much facilitated. The balloon, by orders from the deck of the Implacable, was arrested at different altitudes, and Lieut. Serpette was enabled, by the aid of powerful field glasses, to survey the seaward horizon and count passing vessels, distinguish their class, rig, and nationality, or the course they were making. All these indications were passed instantly and *viva voce* to the attendance on the Implacable, which included, among other superior officers of the two services, Admirals Dupetit-Thouars and Amet. Signals were also readily exchanged by flags from the balloon to the nearest coast guard stations on shore, and the state of the vicinity of the ranges of look-out to the north of Corsica, and from Nice to the eastward and Marseilles to the west, were duly reported to the deck. Another ascent was made later the same day to the height of 1,300 feet, where Lieut. Serpette obtained some photographic views, and after signaling in turn to the Colbert, the flag ship of Vice-Admiral Amet, and corresponding with the Implacable, the end of the cable was transferred from the latter vessel to a steam launch. The examining committee having taken their places in the launch, they proceeded with the attached balloon a short distance out to sea and around all the vessels at anchor in the roads, composing the Amet squadron. Communications with the occupants of the balloon were continued by various methods, without interruption, during the progress, until finally the cable, into whose manufacture, it may be remarked, floss silk largely enters, was brought back to the Implacable, secured, wound in, and the balloon brought to deck after being over four hours in the air. Lieut. Serpette was warmly congratulated by the members of the Admiralty Committee upon the successful solution of the question of determining reconnaissances afloat from aerial observation. It is arranged that the Implacable will follow the evolutionary squadron on the next cruise to continue similar experiments in the open seas. —*Broad Arrow.*

Canadian Tea.

Our scientific editor has been at a five o'clock Labrador tea. The beverage was a success—rated by some as superior to China teas. It was prepared simply as follows: Leaves of the present season. Boiling water poured on, and kept covered for about twenty minutes; kept nearly to boiling point—but not allowed to boil. Sweetened with refined sugar. Cream or milk added. The dried leaf of *Ledum latifolium* could be put on the market, allowing the widest margin, at ten cents per pound.—*Educational Review.*

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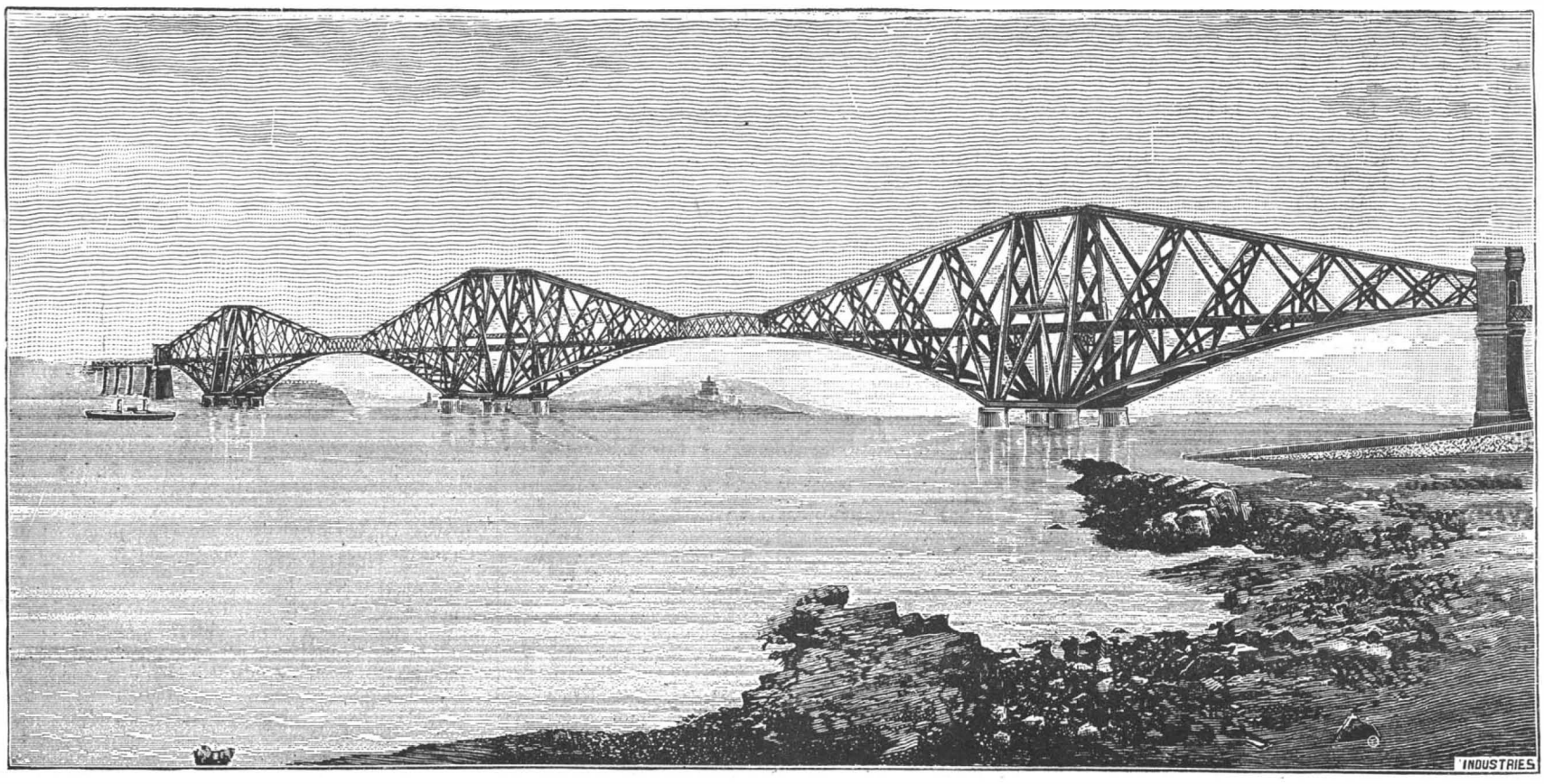
The Jumbo Lace Machine.

Like most other industries, that of the Nottingham lace trade has had to encounter a period of depression, from which it has not yet wholly emerged. Improvements in details of manufacture have, from time to time, been introduced; but, as a rule, they have not been of such a decisive and thorough character as to constitute a radical advance. For some little time past, however, some improved lace machines have been quietly at work in the lace factory of T. Hooley (Limited), at Long Eaton, near Nottingham, and have proved to be an important means of bringing about a better condition of things for their owners. These machines are known as the "Jumbo" lace machines, and were so named from their size being much greater than that of the ordinary lace frames, although the increase in size is simply nothing more than an increased width. In the early days of the Nottingham lace trade, and, indeed, not many years back, a machine 70 in. or 80 in. wide was an exception, and was regarded as a wonder. As, however, mechanical science advanced, lace frames were made wider, until in time a width of about 150 in. was reached. But here improvement in this direction stopped, for any attempt to increase this width was attended with failure, inasmuch as the movable bars of the machine when over a given length sagged and vibrated, and, to use a term in the trade, would not "gate" when the machine was at work, thus causing frequent breakage of threads and consequent damage to the lace in course of manufacture. Even with the ordinary 150 in. machine a considerable amount of damage is frequently done to the lace through the breaking of threads. What the bar really wanted was a support in the center of its length, but for long it was not seen how this was to be accomplished without causing interference with the other working parts. It has, however, now been accomplished in a very simple but effective manner in the Jumbo machines, eleven of which, each weighing seven tons, we recently saw in operation at Messrs. Hooley's works, where they have been running for the past twelve months. The manner in which this has been effected is merely by giving the movable bars a support in the center of their length, which support is worked automatically by a cam action, and moves with the bars. By means of this arrangement the machines are now made 200 in. wide, the moving bars being supported at the center, which practically gives two stiff machines of 100 in. each in one continuous length. This improvement in no way interferes with the lace, nor does it cause the threads to break to any appreciable extent, the work of making good the lace by hand sewing after it comes from the machine being greatly reduced.

The practical outcome of this invention is an increase of 25 per cent in the output of each Jumbo machine, the work being 200 in. wide instead of 150 in. But this improved yield does not involve any extra working expenses beyond the mere cost of the thread, for the lace is produced from the same cards, with the same amount of driving power and supervision as the ordinary 150 in. lace, and it is dressed in the same way. After the first cost, which is comparatively small, it is therefore a practically clear gain of 25 per cent to the users. Messrs. Hooley are building a new factory at Sandiacre, which is now nearly completed, and which will be stocked entirely with Jumbo frames.—*London Times.*

THE FORTH BRIDGE

We give from *Industries* a sketch of the Forth Bridge, showing it as it will appear when finished, with diagrams indicating the progress of its construction up to the end of May, 1888. It will be seen that the great work is now approaching completion.



GENERAL VIEW OF THE STRUCTURE AS COMPLETED.

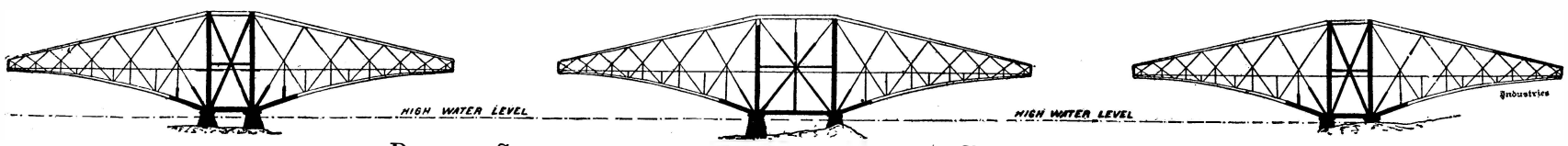
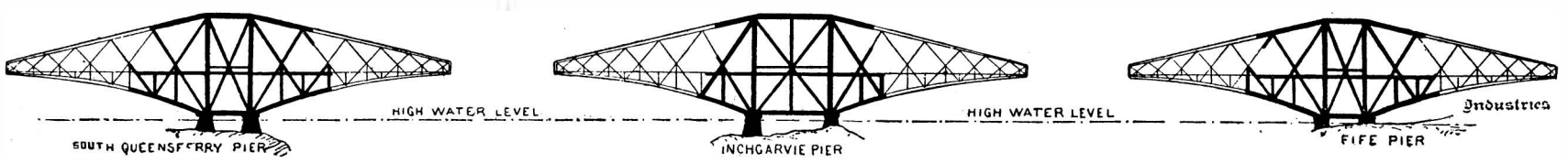


DIAGRAM SHOWING THE WORK ERECTED UP TO THE END OF JUNE, 1887.



THE FORTH BRIDGE, NEAR EDINBURGH.

This remarkable structure is situated at Queen's Ferry, about ten miles from Edinburgh. It crosses the Forth, an arm of the North Sea. We are apt to think that the great suspension bridge between New York and Brooklyn is a work of great size, but it is rather small when compared with the Forth Bridge. The latter has two main spans, each 1,710 feet in length, which is 114½ feet longer than the span of the Brooklyn Bridge. The three main towers of the Forth Bridge are 375 feet high. The total length of the bridge is 8,084 feet.

The bridge is built on the cantilever system, of steel, of which there will be about 42,000 tons used in the superstructure.

The St. Louis Bridge.

The beautiful bridge built by Captain Eads over the Mississippi River at St. Louis, bold in its design and excellent in its execution, is an object of admiration to all who visit it; but the impression of its importance, says *Scribner's Magazine*, would be greatly magnified if the part below the surface of the water, which bears the massive towers, and which extends to a depth twice as great as the height of the pier above the water, could be visible. There are three steel arches, the center one having a span of 520 feet, and each side arch a span of 502 feet. Each span has four parallel arches or ribs, and each arch is composed of two cylindrical steel tubes, eighteen inches in exterior diameter, one acting as the upper and the other as the lower chord of the arch. The tubes are in sections, each twelve feet long, and connected by screw joints. The thickness of the steel forming the tubes runs from one and three-sixteenths to two and one-eighth inches. These upper and lower tubes are parallel and twelve feet apart, connected by a single system of diagonal bracing.

The double tracks of the railroad run through the bridge adjacent to the side arches of the elevation of the highest point of the lower tube. The carriage road and footpaths extend the full width of the bridge, and are carried, by braced vertical posts, at an elevation of twenty-three feet above the railroad. The clear headway is fifty-five feet above ordinary high water. The approaches on each side are masonry viaducts, and the railway connects with the city station by a tunnel nearly a mile in length. The great tubular ribs were built out from each side of a pier, the weight on one side acting as a counterpoise for the construction on the other side of the pier. They were thus gradually and systematically projected over the river, without support from below, till they met at the middle of the span, when the last central connecting tube was put in place by an ingenious mechanical arrangement, and the arch became self-supporting.

A Seaweed Dye.

F. Nettlefold, F.C.S., states in the *Chemical News* that, while experimenting on the production of gelatinous gun cotton, it occurred to the experimenter to nitrate alginic acid. This formed a low nitrated body, which was not analyzed. It was sufficiently elastic on compression, but not explosive. When dissolved in water in alkaline solution, it gave a brown color. The original color of the nitro-alginic acid was bright yellow and insoluble in water.

Unmordanted cotton dyed a fine Bismarck brown color, which was fast to soap, more than many aniline colors, equaling chrysoidine. Mordanting with alumina or tartar emetic did not increase the fastness or the depth of the color. The depth of shade was considerable, and could be worked to a great intensity. In an acid solution the dye failed to attach itself to the fiber, ammonia being the best alkali.

For wool the brown dye appeared to have little power of attraction. Mordanting did not increase the depth of the dye.

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THE GATE HOUSE AND NORTHERN TERMINUS OF THE NEW AQUEDUCT.

Among all the criticisms which have been applied to the new aqueduct, upon which the future water supply of New York is to depend, no unfavorable ones can be found which are directed against the upper section, including the main gate house and connections. This portion has been exempt from the judgments so freely passed upon the main line. The majority of the operations have been conducted in the open air. Far less chance was given for carelessly executing the work than existed in the underground tunnels, and the desire of the city engineers to make the work a perfect one has been seconded to the utmost by the contractors.

We illustrate in the present issue the operations now in progress at the upper end of the aqueduct. They comprise the new gate house and its connections with the new and old aqueducts, with the present Croton Lake, and with the future reservoir to be established by the erection of the Quaker Bridge Dam.

The site of the work is Croton Falls. Taking advantage of the somewhat precipitous character of the banks of the Croton River at this point, the engineers in charge of the original aqueduct built here the famous Croton Dam. This impounds the waters of the river and forms the beautiful Croton Lake. The sloping banks that surround it form an admirable watershed. They are thinly settled, and in spite of many suggestions of contamination by factories, the inspection of the country tends to reassure the observer of the good character of the water supply.

On the southern bank of the lake just above the dam is situated the old gate house. This is the one now in use, and which has done service for so many years in the past. From it the old aqueduct starts, running westward for a long distance before it turns to the south. The object of its builders was to follow a given contour line very nearly, so as to avoid high or low work. It was their desire to make it as much as possible open cut work. This accounts for its sinuous line, its route being determined by the inequalities of the surface.

A short distance south and west of the old gate house is the terminus of the new aqueduct. This was built on principles the very opposite of those controlling the erection of its predecessor. The object was to make a rock tunnel which should be as far as possible an efficient conduit, without any lining, save in some weak or exposed places. Very properly, this design was supplemented by the adoption of a brick lining for the entire tunnel, backed up by rubble masonry. The latter feature has been criticised by some as an unnecessary expenditure, but from an enlightened point of view, it was eminently correct. The aqueduct should be of the best possible description, and the thought of any economy at the sacrifice of strength or durability is not to be tolerated. We have already illustrated the work on the main line. Its defects, we have shown, are in a fair way of being remedied.

This aqueduct starts from Croton Falls, and runs south and east, taking an almost direct line for the city. Its direction at starting is nearly opposite to that of

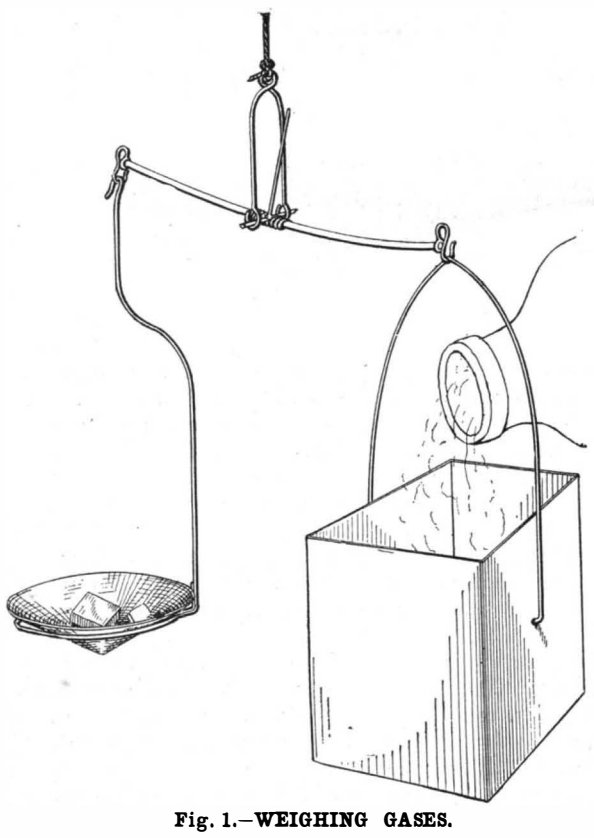
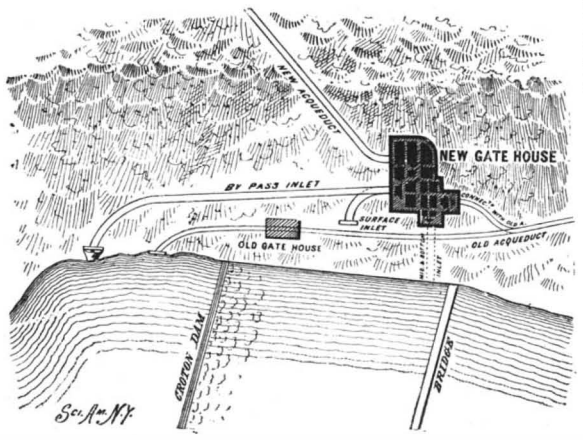


Fig. 1.—WEIGHING GASES.

the old aqueduct. The character of a tunnel in solid rock was obtained by the selection of such a line. As far as possible, open cuts and soft ground were avoided. Conditions exactly opposite to those sought for by the old engineers were desired.

On the south side of the Croton Dam, a high hill of solid gneiss rock rises. Through this the aqueduct is driven. So precipitous was the bank, that there was no room for the erection of a gate house. The first operation, therefore, was to establish a platform by blasting out the rock. This was done, and an immense notch was formed, about ninety feet wide and upward of a hundred feet deep. At the back, the cliff left by blasting rises to a great height. Within this notch the foundations of the new gate house were laid.

The masonry is in three materials. Part is in course work of large blocks of limestone. The facings are in similar work of granite. Some of the partition walls are of brick. The whole is laid in Portland cement. As the building does not extend back to the natural rock, the intervening space is filled with concrete. In some places a thickness of over twenty feet of such filling is used. The new aqueduct, sweeping toward the west, enters the building at its southeast corner.



GENERAL PLAN OF CONNECTIONS AT NORTHERN TERMINUS OF THE NEW YORK AQUEDUCT.

At the northeast corner two inlets, one vertically above the other, are situated. The lower one is termed the by-pass inlet. This provides for the withdrawal of water from the present Croton Lake. Forty-four and one-half feet above it is a second inlet. This emerges from the bank far above the level of the top of the dam and west of its line. It is designed as a surface outlet for the new lake to be established by the Quaker Bridge Dam. Finally, on the north side of the building two additional inlets are arranged. One is at the level of the by-pass; the other, vertically above it, is sixteen feet higher in elevation. These also open into the valley west of the dam. One is termed the bottom inlet, the other the middle inlet.

Until Quaker Bridge Dam shall have been finished, only one inlet will be operative. This is the by-pass inlet. When the new aqueduct begins its work, it will receive all its water through this. The other three inlets are for use when the new lake will be established. Then the present Croton Dam will be immersed under many feet of water. The three inlets now exposed will also be submerged, and water can be taken from top, middle, or bottom layer, at will, of the new lake. Each inlet is circular and fourteen feet six inches in diameter.

There is no intention of abandoning the present aqueduct. Hence a second outlet is arranged which ultimately is to connect with it. This starts from the northwest corner of the gate house, and, sweeping toward the north, is eventually to be joined to the old aqueduct. Its diameter is eight feet six inches. It is circular in section.

The general plan of the building is well shown in the bird's eye view of its foundation. Some of the minor features do not appear, as they are hidden by the superincumbent masonry. Thus, a chamber is arranged for a turbine which is to supply power for the different operations. A drainage well and sump are arranged to keep the chambers clear of sediment. When completed, it will be one of the most substantial and complete buildings of its class in the world. Its foundations, as is clear from what we have said, will be almost monolithic in character.

As the submersion of much of the present roadway is inevitable when the great dam will be completed, a new one has been included in the plans. Along the front of the river bank a high retaining wall is to be carried, and the space back of it is to be filled in. The new road will run along this between the gate house and the reservoir.

The change to be effected in the surrounding country by the Quaker Bridge Dam is very great. The sites of many buildings will be immersed. The water will rise above the level of the old gate house, and will wash against the retaining wall nearly as high as its coping. The present lake will be increased immensely in area as regards the portion above the Croton Dam, while many miles of country between it and Quaker Bridge will also be converted into a lake. The scene of the operations we describe is well worth a visit, and the contrast between the lake of to-day and that of the next decade will be a most impressive one.

THE man who has "grit" and ability and is willing to start in business, in a small way, usually makes a success of it.

The Mosquito a Blessing to Man.

A lecture was recently delivered at Madras, India, on that interesting and familiar pest, the mosquito. The lecturer, Mr. H. Sullivan Thomas, asserts that it is only the female mosquito that does the biting. He considers the mosquito a most useful pest, seven-eighths of its existence being devoted to the service of men and only one-eighth to their annoyance. It exists in the larval state twenty-one days, and during that period engages in sanitary work with ardor and thoroughness. Wherever there is dirty water, wherever there is a filthy drain, there the mosquito larvæ are to be found in hundreds, voraciously devouring the contaminating matter.—*New Orleans Times-Democrat.*

SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

WEIGHING GASES.

In former experiments illustrating the diffusion of gases, it was shown that carbonic acid gas was very much heavier than air, by pouring the gas from one vessel to another, thus to a great extent displacing the air in the receiving vessel, in the same manner as it would be displaced by the pouring in of a liquid. In the case of pure hydrogen or illuminating gas, the order of things was reversed; *i. e.*, to fill the vessel it was necessary to invert it, so that the air might be displaced by the rising of the gas, which is so much lighter than air.

To show visibly that one gas is heavier than air and the other lighter, a pair of balances may be pressed into the service. If the balances are not at hand, a pair may readily be made of wire, as shown in the engraving. All the pivots should be made V-shaped, to reduce the friction to a minimum. The pivot of the beam should be a little higher than the bearing surface of the hooks at the ends of the beam. The conical scale pan may be made of paper, by radially slitting a disk, overlapping the edges, and sticking them together. The paper box for receiving the gas is five inches in each of its dimensions, and is suspended from the scale beam by a wire stirrup, so that it may be reversed. After bringing the scale to equilibrium in air by placing some small weights in the pan, the air contained by the box may be displaced by pouring in carbonic acid gas. The box will immediately descend, showing that carbonic acid gas is heavier than air. Allowing the weights in the pan to remain the same, the paper box is inverted, when the carbonic acid falls out, and air takes its place. The balance beam again becomes horizontal. Now, by opening a jar of hydrogen under the box, the air is again displaced, this time, however, by the rising of the inflowing gas. When the greater portion of the air is replaced by hydrogen, the box rises, showing by its buoyancy that its contents are lighter than air. If the balance is allowed to remain for a time, the gas will be diffused, and the balance beam will return again to the horizontal position.

In Fig. 2 is shown a very simple wheel, to be operated by gases. The wheel consists of a disk of light but stiff card board, mounted between two corks on a straight knitting needle, and provided around its periphery with buckets formed of squares of writing paper, attached to the periphery of the disk by two adjoining

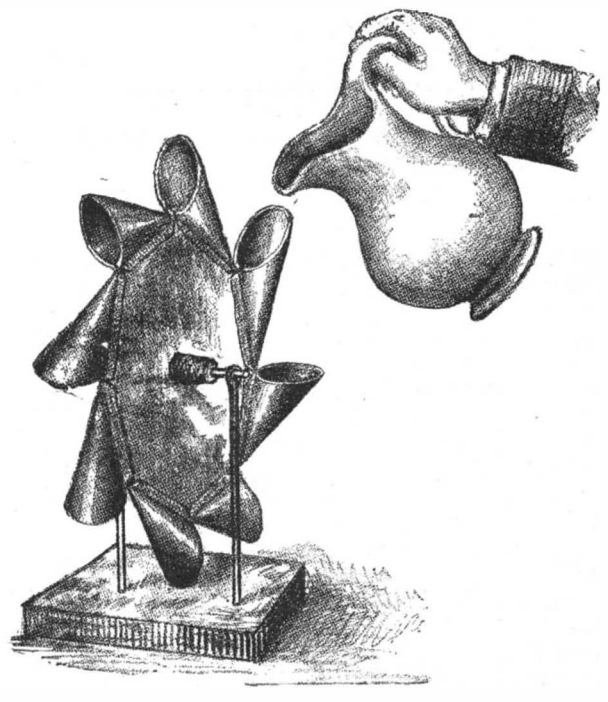


Fig. 2.—GAS WHEEL.

edges so as to form hollow cones, as shown. The knitting needle is journaled in wire or wooden standards, and lubricated so that it may turn freely. Carbonic acid gas may be generated in a pitcher and poured upon the wheel in the manner illustrated. By making the wheel large enough and carefully balancing it, it may be turned by liberating hydrogen gas under the mouths of the buckets.

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Indian Horsemanship.

A correspondent of the Omaha *Herald* has been among the Indians, and this is how he tells of what he saw:

In the Indian camp of the Arapahoe chief Friday, we saw many curious scenes and learned much of Indian life. One day Friday said to me he would like to show off his young men and let me see how well they could ride. At first I expected some treachery, as the whole herd of ponies was in the hands of the troops. The old chief, however, was so earnest and apparently honest about it, I told the captain, who had the herd in charge, he might let Friday have fifty ponies for his young men. In about an hour they drew up before the tents in war paint and feathers, and were as fine a looking set of young fellows as I have ever seen. Hardly one but was six feet in height and beautifully proportioned. They sat their horses like centaurs, and were ease and grace itself in the saddle. At a signal from the chief they began their movements with a yell that sent the blood curdling to the heart, and was enough, if heard unawares or in the night time, to make one's hair stand on end. In a moment they had disappeared over a neighboring hill to the right, and I thought they had gone; but hearing a mighty trampling of horses, I looked to the left, and there they came. I can compare it to nothing but the wind, and they swept by so compact that they looked like a ball of horses and men.

Splitting in two, one body swept to the right and another to the left, and again disappeared. In about two minutes the two bodies charged each other in solid lines, and I waited breathlessly for the shock, but, as the horses' heads almost touched each other, the files skillfully opened to the right and left, and the lines passed through the intervals without touching. Wheeling to the right about they passed back in an instant, and again disappeared over the hills. It was about fifteen minutes before they came in sight, and Friday informed me that they were blowing their horses. Presently on they came and wheeled by fours, formed columns, and finally deployed as skirmishers. It was now we saw the finest individual horsemanship. Some would approach lying so close to the pony's back that nothing but the horse could be seen. Others stood up and rode as circus men do. Some would hang with one foot and one hand on the horses and sweep by, their bodies completely protected by the bodies of the animals. Some leaped upon the ground, holding to the mane of the horse, and after running a step or two would swing themselves up on the backs of the horses again as easily as any circus man could do it. The positions they assumed and the feats of horsemanship they performed were incredible, and I doubt if anything outside of a circus ring ever equaled it. They would throw objects on the ground and pick them up again while passing at full speed, the warriors hanging to the sides of the horses with one foot and one hand. They drew bows and shot arrows from underneath the necks and even the bellies of their horses while riding at a fast gallop.

Our cavalry could not learn to ride as well as these Indians did if each man was trained for twenty years. They exchanged horses while riding, and got behind each other. One man would fall off his horse as if wounded, and two others would ride up beside him, and, taking him by an arm and leg, swing him between their horses and carry him off. The exhibition, or drill, as Friday called it, lasted nearly two hours, and the men and horses were completely exhausted. I had never seen such magnificent feats of horsemanship in my life, and I freely said so. At this Friday was much pleased, and calling up the young men, repeated to them in a loud voice what I had said, and added a few words of his own, complimenting them. The young men were very proud of the manner in which they had acquitted themselves, and I could imagine the feelings of their parents and sweethearts. The performers were much worn out, some of them being hardly able to stand after their violent exercise, and all the evening I saw them lying in the lodges, where the Indian women brought them food, bathed their hands, arms, and limbs, and combed their hair.

British Frozen Meat Imports.

How firmly the trade in frozen meat is now established in the United Kingdom may be gathered from the following figures, which represent the number of carcasses of mutton and lamb imported for the first quarter of the present and three previous years:

From	1885.	1886.	1887.	1888.
Australia	26,886	2,364	32,366	16,192
New Zealand	97,538	155,974	128,397	209,096
River Plate, etc.	51,682	91,405	83,548	25,097
Totals	176,106	249,743	244,311	250,385

The figures here given from the *British Trade Journal* refer only to the numbers imported *via* London. The bulk of the River Plate frozen meat is now directed to Liverpool, and how extensive it is "may be inferred from the fact that the frozen mutton alone, imported there from the River Plate, during the first three months of the present year, amounted to 163,000 carcasses."

New Steel Casting Process.

The process of Bott & Cousins, as described by the inventors, consists in passing molten steel or iron through a bath or filtering medium of a purifying and deoxidizing alloy of less specific gravity than either steel or iron, such bath or filtering medium rising and forming a stratum or film on the surface of the molten steel or iron, through which every particle of such steel or iron subsequently melted passes before reaching the lower part of the furnace from which it is tapped. The fusion is effected in a cupola of Mr. Bott's own design. The lower part or crucible of the cupola is surrounded by a cylinder of larger diameter, forming a chamber around the tuyeres, in which the air becomes effectually heated. With a pressure of blast such as is usually sufficient for an ordinary foundry cupola, Mr. Bott's cupola will melt a mixture of 85 per cent of Bessemer rail scrap and 15 per cent of hematite pig, which in its descent is made to pass through an alloy, the chief active component of which is titanium. The alloy in question, which is produced in the cupola at the commencement of the operation, is obtained by using Belfast aluminous ore, which contains from 10 to 12 per cent of titanium. The stratum of alloy should not be less than 1 in. in thickness for each ton of iron or steel to be treated. The effect of passing the steel as it melts through this deoxidizing layer is to clear it of impurities, especially those of a gaseous character, and the resulting castings are free from honeycombs or blowholes. Indeed, it is chiefly in this respect that the process is considered to be of greatest value, as a vast number of articles which, on account of the propensity referred to, could not be made as castings, but had to be either forged or rolled, are now actually being made by Bott & Cousins' process as castings, and that in green sand.

Some expansion joints for Knapp boiler tubes 3-16 in. thick were shown, which gave perhaps as good an idea of what the process is capable of as the more ponderous, but equally thin, chimney bases and domes, which are being made to the order of the Midland Railway Company. So valued is this property of soundness in castings, especially for ordnance purposes, when combined with the requisite tenacity and ductility of the material, that the attention of the gun makers to the process was very readily obtained, and their growing confidence is well illustrated by the repeated orders for various articles which enter into the composition of the most modern pieces. In this connection it may be mentioned that the Turkish government are making arrangements to purchase the right of using the process at the Imperial Ottoman Arsenal. The ductile character of the material was clearly shown by a number of castings which had been twisted and battered into such shapes as one would imagine only the mildest Siemens steel forgings could be made to assume. A quantity of small rings and spanners had been thus treated, and some small cog wheels showed the admirable toughness of the metal by the way in which the teeth had stood without fracture the blows of a heavy hammer, the teeth having simply bent over and become flattened in the adjoining spaces. This ductility is obtained by annealing the castings in a suitable furnace, and although cast in steel of 1·50 per cent to 1·80 per cent of carbon, the inventors claim that the castings can be reduced to the mildest temper by packing them in sand or lime, by reason of the material containing no graphitic carbon, as is the case with malleable cast iron, "the annealing simply settling the strain incidental to cooling and crystallization."

The inventors claim that the time required for annealing in this process is much shorter than with ordinary steel castings, and that therefore delivery can always be effected within a week from receipt of order. Other claims are also made which are of considerable importance.

It is well known that, to obtain a sound casting in steel, with most methods in use, a very high "riser" is necessary, which also means a high gate, and consequent waste of labor and material. By this process, however, the metal, being freed from all gaseous constituents, lies quiet in the moulds, and the precaution of a high riser is found unnecessary, which is no slight advantage, especially in casting small articles, when the weight of the waste metal may by the older processes considerably exceed that of the articles themselves.

The purification referred to does not affect the temperature of the molten metal at the moment of casting, the steel running quickly into the moulds, as was evidenced by the thinness and superficial extent of many of the specimens shown. To obtain some of these articles, the steel is made to contain as much as 1·50 per cent to 1·80 per cent of combined carbon, and it will therefore be obvious that the material can be made to take a sharp cutting edge.

No comparative series of tensile tests appear as yet to have been made, the inventors having chiefly directed their endeavors to obtaining soundness and ductility in their castings; but some isolated experiments have given 32 tons per square inch, combined with great ductility.

Messrs. Bott & Cousins believe their invention to be specially applicable to the production of steel shells and projectiles, the method for the manufacture of which they describe as follows: The green sand moulds are formed in the usual way, and dusted with plumbago or other heat-resisting facing, sufficient to withstand the heat of the melted steel. The core of the shell or other article is made collapsible. The metal, after being melted and passed through the alloy, is drawn off and poured into the moulds in the usual way. As the castings begin to cool they contract, and the outer mould, being changed from green to dry sand, peels off; while the inner mould or core collapses and falls to pieces, thus allowing the articles to contract freely and equally, which is impossible if a baked composition mould and core had been used. The collapsible cores described have a green sand facing on a foundation of hemp or other fiber, carried on a perforated tube.

We may state that the process has passed far beyond the mere experimental stage, as it has been in operation at Penney & Co.'s, limited, Lincoln, who have been working it since October of 1887; and since February of this year they have been steadily turning out about 3 tons of these castings per week, which, considering that a vast number of the castings only weigh a few ounces, is a sufficient proof of the appreciation in which this firm hold the process.

There can be no doubt that the simplicity of the plant required, and the easy adaptability of the process to existing conditions, are advantages of such magnitude that it must quickly become a powerful co-operator in the great field which is daily enlarging, and in which the manufacturers of the steel castings are reaping a rich harvest.—*Industries.*

A New Constituent of Tea.

At a recent meeting of the Physiological Society, Berlin, Prof. Kossel spoke on a new constituent of tea. Inasmuch as the presence of caffein in tea does not suffice to explain its physiological action, he had examined it for other bases, and found in the leaves of tea, in addition to adenin, a new well characterized base whose composition is $C_7H_8N_4O_2$, to which he has given the name of theophyllin. Theobromin and paraxanthin have the same chemical composition as theophyllin, but the latter differs from the former by a series of well marked chemical reactions. One question of special interest was as to the constitution of the new base, which belongs to that class of substances known as the xanthin bodies. Fischer has shown that xanthin yields alloxan and urea when oxidized; and, similarly, it is known that theobromin is dimethylxanthin, yielding, by oxidation, methylalloxan and methylurea; as also that caffein is trimethylxanthin, yielding, by oxidation, dimethylalloxan and monomethylurea. The question hence arose as to the constitution of the new base, which, since it is isomeric with theobromin, is also presumably a dimethylxanthin. Since the speaker was in possession of so limited a quantity of the substance that he could not proceed to oxidize it, he proceeded by a different method, and introduced a methyl group into the molecule of theophyllin. On performing this experiment he obtained caffein, from which it must be concluded that theophyllin contains one methyl group united to a residue of urea, and one to a residue of alloxan, and has therefore a constitution identical with that of theobromin. It still remains to investigate the physiological action of the new base.

An Interesting Trade Mark Decision.

Vice-Chancellor Vanfleet, of New Jersey, rendered a decision, on July 24, which is of much interest as affirming the true legal status of a trade mark. The Cigarmakers' International Union have a label which they authorize any manufacturer of cigars employing members of their association to use on his packages or boxes. The label has been counterfeited, and suit was brought under the trade mark law against a manufacturer alleged to have used such labels. The defense was made that no cause of action was shown, and that the label was no trade mark.

The court sustained the latter ground of defense. It affirmed that a trade mark must have three characters. It must be new as regards the article to which it is applied; it must be applied to some article of traffic; and the proprietor must put upon the market his article marked with the trade mark. No person can acquire right to a trade mark unless he puts merchandise or a vendible commodity on the market marked or distinguished by his particular mark. As the complainants had not shown that they ever placed the label upon their own goods, their complaint was without force. The court held that mere adoption of a mark and a public declaration that the mark so adopted will be used to distinguish goods to be put on the market at a future time creates no right.

Artificial Mica.

A process is described by M. Doelter by means of which the author has artificially reproduced the chief minerals of the mica group, as well as of natural scapolite. He has already effected the synthesis of biotite, phlogopite, muscovite, and lepidolite (zinnwaldite variety).

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SAND GROUSE (*Syrrhaptes paradoxus*).

From articles published in the German papers during the last few weeks it appears that this interesting bird is becoming more common in Germany. The first appearance of the *Syrrhaptes*, whose home is in Asia, especially Tartary and Mongolia, was in 1857, and created a great sensation because the bird had only been known to zoologists and visitors at zoological gardens since its accidental discovery by Pallas during his travels through Siberia (1768 to 1774). It belongs to the *Pteroclidæ* family, but it shows many characteristic features peculiar to itself. Its anatomical construction has been said to combine the bustard, the dove, and the domestic fowl. It is of about the same size as the domestic dove, and the color of its plumage varies from ashy gray to light yellow, matching that of the wide desert plains of its native steppes so well that it is scarcely discernible even with the sharpest eyes. Its head and beak are proportionately small, and the wings, which run out into long, sharp points, do not cross and cover the back, but hang down at the sides and extend in the same direction as the tail, which is held horizontally, the middle feathers being pointed also. Its feet are especially remarkable; there is no rear toe and the three fore toes are thickly covered with feathers, so that the foot looks like a bent limb ill-adapted for scratching, or like a little fingerless glove. With his slow, tripping gait, the bird would remain far behind in a race with the red-legged partridge. His noisy flight seems very slow at first, but soon becomes remarkably rapid, making it exceedingly difficult for a pursuing falcon to carry out his murderous work.

These birds build clumsy nests on the ground, in which the hen lays not more than three or four eggs, so that the increase of the *Syrrhaptes* is about the same as that of the partridge. The eggs are of a pure elliptical form, their ground color varying from a light greenish gray to a dirty brownish gray, and on this ground there are usually dark brown spots. Its principal nourishment consists of grass seed and tender leaves. It will be a long time before this bird can be considered as game, although special laws have been made for its protection.—*Illustrirte Zeitung.*

Santa Monica, Cal., Breakwater.

Gen. Duane reported to the Secretary of War, in respect to the above work, that the construction of such a breakwater is believed to be entirely feasible, but its cost will be necessarily great, probably not less than $6,000,000; and that the work could not be advantageously undertaken without at least an appropriation of $600,000 to permit a proper beginning.

Trees in Washington.

Mr. Peter Henderson, in the last number of *Harper's Magazine*, describes the tree planting which has been accomplished in the city of Washington during the last fifteen years. No less than 120 miles of streets, or 240 miles of trees, have been planted in that time, and in no other American city has street planting ever been attempted on anything like the same scale, or has produced results immediately so satisfactory. An examination, however, of the list of trees which have been planted, shows that the commission who have controlled these plantations have been governed by the desire for immediate effect rather than for the permanent embellishment of the city.

White maples, for example, line fifty-five miles of streets, or nearly one-half of the distance planted, sixteen miles are planted with the cottonwood, and ten miles with the ash-leaved maple or box elder. These are all excellent trees for the prairies of Nebraska or Kansas, where trees are needed that can grow rapidly in a dry soil, and where all other considerations are secondary to immediate results, but they are entirely out of place in a city of the architectural pretensions and of the climate of Washington.

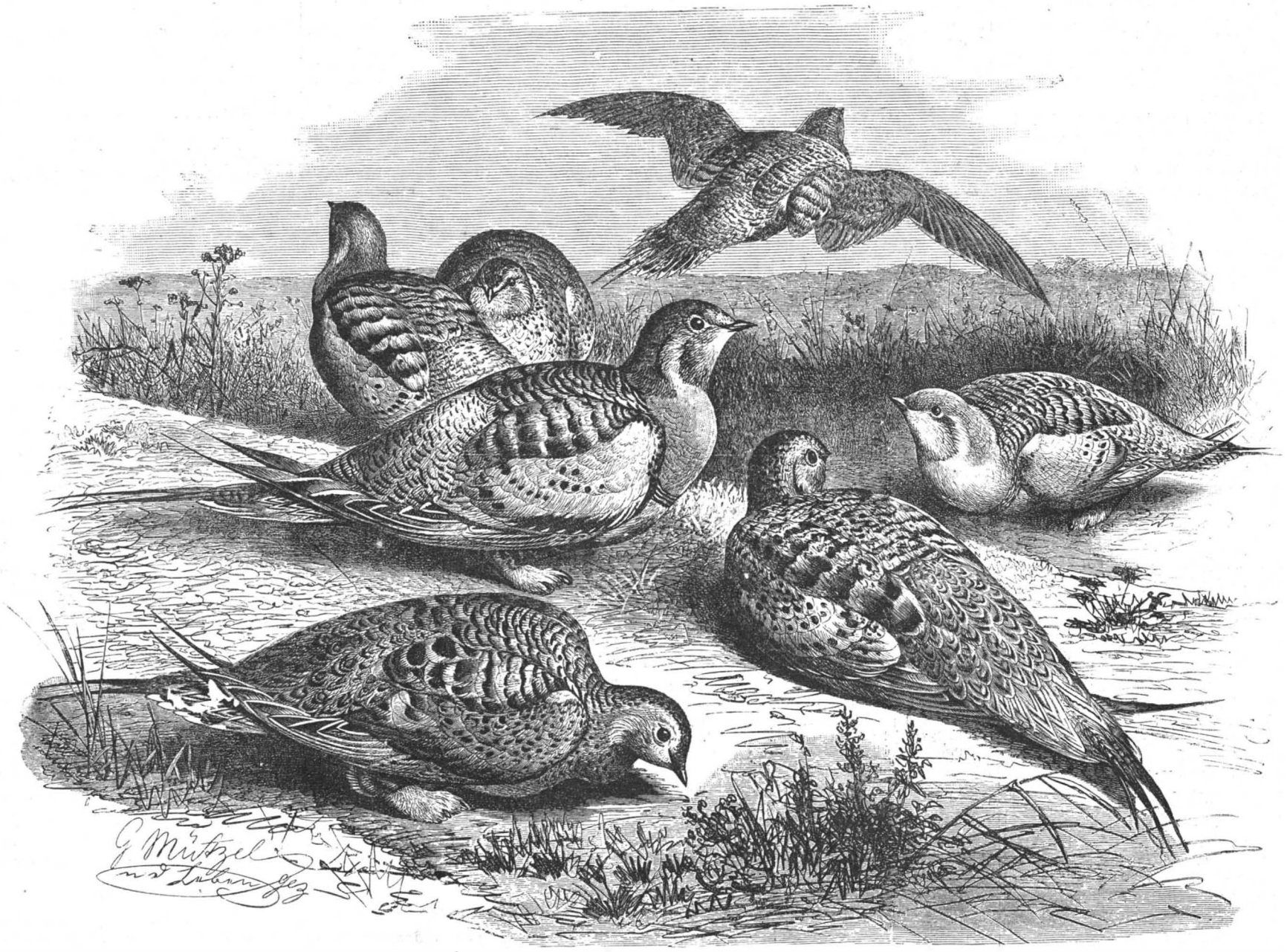
They are trees with brittle branches, and neither long-lived nor in any way suited to adorn the capital of a country like the United States, rich in trees unsurpassed in beauty and variety. Indeed, it would be difficult to select three deciduous trees in the forests of this country less fitted for this particular purpose. They are very easily and quickly raised, they are readily transplanted, and they grow with great rapidity. They soon become unshapely and unsatisfactory, however, and any city where the streets are planted with them will have a cheap appearance, whatever may be the character of its buildings.

The number of fine trees which could be used to adorn appropriately the streets of Washington is considerable. The tulip tree is perfectly at home in that climate. It is one of the noblest trees of the American forest. There are few more beautiful trees anywhere. The commission have planted only 1,712 tulip trees. Some of the American oaks are admirable street trees, notably the pin oak, the red oak, the willow oak, the scarlet oak, and the shingle oak. These all thrive in the neighborhood of Washington, and they are all trees which can be easily grown and transplanted. They grow rapidly, too, as does the tulip tree, although less rapidly in youth than cottonwoods and soft maples, but they go on increasing in beauty for a century, and might be expected to last in Washington for a much longer period even.

The commission have planted 273 oaks all told, including some worthless European varieties. Only 832 sugar maples have been planted, although this is one of the best street trees in the United States, while ten miles of Norway maples have been planted, in spite of the fact that it is in every way an inferior tree, and often disfigured in this country in summer by thrip.

The white poplar of Europe is one of the ugliest trees ever introduced into this country; 1,863 of these have been set along the Washington streets, or 600 more than the number of honey locusts used, yet the honey locust is an excellent street tree—in many respects one of the best which has ever been tried in this country for the purpose. The trees to which we have here called attention—and there are many others which might have been selected in preference to those employed by the commission—have all been successfully planted in towns in different parts of the country. In the town of Flushing in this State, for example, where, perhaps, more than in any other in this country which we can now recall, there are lessons in street planting to be learned, both in regard to what trees to plant and what trees not to plant, there are rows of noble tulip trees, and pin oaks, willow oaks and lindens, which speak for themselves, and show how beautiful a well planted street can be made.

The trees planted in Washington have been badly selected, and the permanent results of these plantations cannot fail to be disappointing. The methods, however, of planting, of pruning, and of protecting the trees adopted by the commission, as described by Mr. Henderson, are admirable, and far ahead of anything which has been done in urban planting in this country. It is not surprising, therefore, that the immediate results obtained are so satisfactory.—*Garden and Forest.*



SAND GROUSE—SYRRHAPTES PARADOXUS.

The Poppy as a Bank Protector.

The *Manufacturers' Record*, in an article recommending opium culture in the South, says that, once sown, the poppy is self-perpetuating, and is, in fact, hard to exterminate, reciting the fact that within the last two or three years eminent French engineers have undertaken the sowing of railroad embankments with poppy seeds, as, when once established, that prolific plant would cover the soil with a network of roots that would prevent it from washing away during heavy rains or from upheaval when frost was coming out of the ground in the spring.

The suggestion seems good enough to warrant a trial. Surely a bank of poppies would present advantages in an æsthetic point of view over a bank of pig weed, thistles, and tomato cans.

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ENGINEERING INVENTIONS.

A car door has been patented by Mr. John W. Shewmaker, of Terre Haute, Ind. It is a sliding door for a freight or grain car, the invention covering various novel constructions and formations of parts of the car and door in relation to each other.

A car coupling has been patented by Mr. William H. Griffith, of Bolivar, Texas. Its construction is such that the coupling pin is normally held in position for engagement with the link, and the latter is also normally held to enter and engage the meeting drawheads and automatically release the coupling pin, avoiding the necessity of train men going between the cars.

A machine for laying railroad tracks has been patented by Mr. Marion Smith, of Durham, Kansas. A flat car has a pivoted truss frame supported at its rear end, a wheel supporting the front end of the truss frame, in combination with a rope passing over a pulley held on the truss frame, and a gauging and drawing device held on each end of the rope, with gripping and supporting devices adapted to travel on the ropes, and other novel features.

AGRICULTURAL INVENTIONS.

A wheel hay rake has been patented by Mr. Henry W. Kramer, of Newtonville, Ind. It is a rake adapted to carry its load to the barn or stack before discharging it, thus avoiding the necessity of loading the hay upon wagons, the invention covering various novel details of construction, combination, and arrangement of parts.

A grain drill has been patented by Mr. Alexander C. McClelland, of Island City, Oregon. For opening the furrow a flat-sided disk is employed, in combination with a plate in contact with it at the forward edge, but separated at the rear side, so that they co-operate to form the furrow, the device also conducting the grain to its place and avoiding side draught.

A harrow has been patented by Messrs. George Melson and Robert H. Harper, of Eugene City, Oregon. This invention covers a novel construction and arrangement of the parts of the harrow frame or beams, and of the headed ends of the teeth shanks or standards, as also a novel formation of the teeth, to promote the lightness, strength, durability and efficiency of the machine.

MISCELLANEOUS INVENTIONS.

Improvements in commodes, earth closets, and similar appliances form the subject of a patent issued to Mr. Charles L. Doll, of St. Louis, Mo. The invention covers a novel construction and combination of parts in commodes or earth closets, and adapted to be readily cleaned.

A photographic bath has been patented by Mr. Alexander Anderson, of Elgin, Scotland. It is provided with means for lifting the negative out of the solution without applying the finger directly to the plate, for which purpose it has a novel form of angled finger pivoted to one end of the bath dish.

An improved gearing has been patented by Mr. Ole O. Kravik, of St. Carl, Dakota Ter. This invention covers novel details and combinations of parts in a gearing for rapidly transmitting motion, and adapted, by duplication of its parts, for obtaining a rotary motion at any desired rate of speed.

A die and dice box has been patented by Mr. Reinhold F. De Grain, of Washington, D. C. It is a closed box or case with a chamber just the width of the dice, and having at one end of the chamber angular recesses where the dice come to rest, with holes through the sides of the case through which the numbers on the sides of the dice may be read.

A cooking stove or range has been patented by Mr. Isaac C. Schuyler, of Falls City, Neb. This invention covers a novel construction and combination of parts in a stove designed to save fuel and prevent radiation of heat into a room, the surplus heat being used to raise the temperature of the draught before it enters the combustion chamber.

A stomach pump has been patented by Mr. Horace W. Parsons, of Wamego, Kansas. This invention covers special constructions and combinations of parts in an apparatus designed for washing out and removing the contents of the stomach, bladder, or other cavities of the body, and also applicable to various surgical and other operations.

A trap for fish or game has been patented by Mr. George H. Kile, of Mound Valley, Kansas. It consists of a cage with an opening having an inwardly tapering passageway, a grating hinged to the lower side of the opening, and double folding guide gratings hinged to the sides of the opening, with other novel features.

A fruit holding device has been patented by Mr. John J. W. Place, of San Mateo, Fla. It is a device for removing the rind from oranges, having a base in which is a pointed spindle, on which the orange is to be impaled, while the base has an annular groove in which the juice may run and will not soil the hands or clothes.

A fire escape has been patented by Messrs. Morris H. Marcus and Otis G. Moore, of Knox, Pa. It consists of a flexible chute held extended by rings, with intermediate elastic bands, and with a blanket or sheet secured to its lower end, that persons may slide through the chute to escape from a fire, the invention being an improvement on a former patented invention of the same inventor.

A fire escape has been patented by Mr. T. R. Budd, of Carthage, N. Y. It is of that class of fire escapes in which the body is suspended from a frame that slides upon a rope attached by one end to some suitable or convenient part of the building, and, by pulling upon the rope below the frame, the person descending, or one upon the ground, may regulate the rate of descent.

A hame has been patented by Mr. William T. Stearns, of Gettysburg, Dakota Ter. Combined with the hame is a staple having along its length open seats for the eye of the trace tug to rest in, in connection with a bar guided upon the end sections of the staple and forced toward the seats by spiral springs, so as to hold the eye in any one of the seats in which it may be adjusted.

An electric governor has been patented by Messrs. Horace W. Parsons and John Hoduit, of Wamego, Kansas. It is a centrifugal governor, with a contact piece moved by the centrifugal action of the governor, and combined therewith is a condenser for preventing sparks at the contact surfaces, for controlling the current from a dynamo and governing the speed of electric motors.

A pea sheller and separator has been patented by Mr. William A. Slappey, of Fort Valley, Ga. It has a cylindrical beater, armed with spikes, journaled in a suitable framing, in connection with a feeding arrangement with a number of fingers, and a fan arranged in a suitable case to force air against the shelled peas and separate them from the husks, dust, etc.

A storage battery has been patented by Mr. John A. Enos, of Boston, Mass. Combined with the battery case and a horizontal shaft arranged to rotate therein are two spirally wound metal ribbons forming the two elements, the ribbons being insulated from each other and attached to the shaft, the invention being also applicable in the construction of primary galvanic batteries.

A current receiver for electric railway cars has also been patented by the same inventor. It is for use with motors operated by storage batteries charged at intervals along the line by contact of terminals with posts or standards connected to a main generator, the car having long conductors adapted to be brought into rubbing contact with brushes on the posts, the conductors being adjustable to be raised or lowered as required in passing under bridges, etc.

SCIENTIFIC AMERICAN BUILDING EDITION.

AUGUST NUMBER.—(No. 34.)

TABLE OF CONTENTS.

1. Elegant plate in colors of a dwelling at Glen Ridge, N. J., with floor plans, sheet of details, etc. Cost, eight thousand five hundred dollars.
2. Plate in colors of a fire engine house of moderate cost. Details and floor plans.
3. Perspective view and floor plans of a residence at Black Rock, Conn. Cost, six thousand dollars.
4. Sketch of an uptown block of attractive residences, New York City.
5. Floor plans and perspective elevation of two Queen Anne cottages, lately completed at Bath Beach, Long Island. Cost, four thousand dollars each.
6. Design and floor plans for a two thousand dollar house lately built at Bridgeport, Conn.
7. Perspective and floor plans of an attractive residence lately built at Bridgeport, Conn. Cost, two thousand eight hundred dollars.
8. A six hundred dollar cottage built lately at Bridgeport, Conn. Perspective and floor plans.
9. Plans and perspective view of a seaside cottage lately erected at Bath Beach, Long Island. Cost, three thousand five hundred dollars.
10. Engraving and floor plans of a neat little double house lately erected at Bridgeport, Conn., costing one thousand eight hundred dollars.
11. A country residence in France. Perspective and plans.
12. Engraving of the palatial stables of Mr. D. Edgar Crouse, Syracuse, N. Y.
13. Plans and perspective for a carriage house, barn, etc. Cost, two thousand two hundred dollars.
14. Elevation and floor plans for a double house costing complete four thousand two hundred dollars.
15. New Congregational Church at Beckenham, Kent, England.
16. Page of designs of New England residences.

Miscellaneous contents: Vegetable glue.—Fourth of July fires.—The slag water closet.—Rust in water pipes.—Laying out the joints of an elliptical vault, illustrated.—The tulip and other trees.—Architectural school houses.—Hanging baskets.—To estimate the power of a stream.—Manufacturing progress in the South.—How to grow quinces.—Mixed wheats.—New ceiling for the Assembly chamber of the New York State Capitol.—Transplanting large pines.—Galveston artesian wells.—Poisonous wall paper and carpets.—The testing of Portland cement.—The humming bird.—Manila hemp in plaster.—A perfect hen house.—Examination questions for plumbers.—Road improvements.—The "Patten" metallic shingles and siding plates, illustrated.—The pool of Bethesda.—Carl Pfeiffer.—Creosote wood preserving stains.—House heating by hot water circulation, illustrated.—Ohio's largest poplar.—Mortar.—Irrigating wheels.—Liquid fish glue.

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Lockwood's Dictionary of Terms used in the practice of Mechanical Engineering, embracing those current in the drawing office, pattern shop, foundry, fitting, turning, smith's and boiler shop, etc., comprising over 6,000 definitions. Edited by a foreman patternmaker. 1888. Price, $3.00. For sale by Munn & Co., 361 Broadway, New York.

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Rotary veneer basket and fruit package machinery. I. E. Merritt Co., Lockport, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) J. A. S. writes: A lightning rod company putting up rods in this section use a copper cable about half an inch in diameter, but do not use any glass insulators at all, only a metal support, allowing the rods to rest against the walls of the building. Is this safe? A. Lightning rods properly put up, that are large enough and have a metallic connection with the water way in the soil, are undoubtedly safe. Insulation is not so desirable as a perfect connection with the underground water. Atmospheric electricity will jump the insulators as quickly as if they were not there, if the ground connection is not perfect. The modern practice has been to use large copper conductors strapped to the building with extra large ground water connections, also of copper. Recent experiments have made it doubtful if the copper is a good material. See SCIENTIFIC AMERICAN, May 18, 1888, p. 312. 2. What causes the engraving of steel ball on last page of SCIENTIFIC AMERICAN to appear as though there was a compass needle quickly vibrating about its center. A pair of good eyes in a light room can readily see it. A. The circular lines produce an optical illusion by rocking the paper around the center. Such effect is more apparent to astigmatic eyes. 3. Where do astronomers count right ascension from? A. From the vernal equinox, or point in the celestial sphere at which the sun crosses the plane of the earth's equator in its ascending or northern passage. Owing to the precession of the equinox of about 50 seconds per year, the right ascension of the heavenly bodies is constantly changing.

(2) T. G. T.—You will find a complete table of the compression of air with the rise in temperature, pressure, and volume, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 279, which we can mail for 10 cents. For preserving fence posts from rotting, either wet or dry, dip the posts or so much of them as will extend from the end to 6 inches above ground in hot coal tar, or use crude petroleum, well soaked in, or strong brine of salt and water boiling, in which immerse the posts for a few minutes or until they heat through. A boiling solution of sulphate of iron or copper half a pound to one gallon of water is also a good preservative. In a good hydraulic ram one-seventh of the water flowing to the ram may be raised four times the height of the fall to the ram, and one-fourteenth part to eight times the fall. The supply pipe should be in length five times the fall.

(3) D. L. P. (Curacao, W. I.) asks: 1. When it is said in the SCIENTIFIC AMERICAN that a planet rises and sets at a certain hour, at what hour will it rise and set here? Our city is situated 12° 6′ latitude, 68° 58′ longitude west of Greenwich. A. The rising and setting time for planets and stars is counted in hours from the sun's meridian, and as every place on the earth has its own solar meridian, the time as given is for any meridian of longitude. The revolution of the earth upon its axis makes the time of rising and setting agree with clock time for every longitude. The case is different for moments of time at which phenomena occur, as of eclipses and the like. In such cases the clock time becomes variable with all meridians and throughout the 24 hours. 2. What can be recommended to make finger nails hard, when too thin? A. Try wetting them occasionally with alum water. 3. What can be done to prevent the rusting of the spindles of our combination iron safe? A. Try vaseline wiped on very thin.

(4) J. M. asks (1) the easiest way to find the horse power of an engine. A. Multiply the area of the cylinder by the mean engine pressure, which may be from 75 to 90 per cent of the boiler pressure, due to the cut-off. Multiply this product by the speed of the piston in feet per minute. Divide the last product by 33,000. 2. How many square feet of heating surface are generally allowed per horse power for steam boiler? A. 14 square feet heating surface for small boilers, 12 square feet in large boilers. 3. Which is the longest bridge in the world? A. The Tay—10,800 feet. Next the Forth Bridge, 9,200 feet long. The Montreal bridge is 8,791 feet long.

(5) G. B. W.—For concrete that does not shrink, use equal parts by measure of Portland or Rosendale cement and clear, sharp sand. Mix quickly to a thin paste with water, and then quickly mix therewith an equal bulk of fine broken stone, put in place and use a large faced hand ram to work the concrete even, with light strokes of the ram. A heavy shovel will answer the purpose for thin concrete. Galvanized iron will not corrode when set in concrete or asphalt composition. Mortar does not corrode galvanized iron. Mortar of lime and sand is cheaper than cement.

(6) R. J. S. writes: I wish to gild a model of clay and to give the gilt surface a very bright polish. Will you oblige me by describing the process by which this can be attained, and also the recipe for imparting to the gold leaf a burnished luster. A. First give the model a coat of shellac varnish, then give it a coat of oil gold size. When this has dried to a point where it is slightly "tacky," apply gold leaf. If you want to burnish it afterward, you should use water gold size in place of oil gold size, and burnish with an agate burnisher. Both operations require considerable skill.

(7) E. A. S. asks: 1. What determines whether or not dry colors mixed up with mortar and cements will be fast and not run? A. Colors not affected by the causticity of the lime will stand in mortar. Natural earth colors will stand well, as will the various oxides of iron, but very few of the chemical colors are serviceable. 2. Are not all the ochers fast colors when so used? A. Yes. 3. The receipt for a cement to unite pieces of cloth and leave them flexible? A. Ordinary white lead paint will unite pieces of cloth and leave them flexible.

(8) S. E. H. asks the most inexpensive and durable coating for the inside of cast iron water tanks for pure clean water. A. The only protection for cast iron water tanks, worthy of consideration, is a paint made with red oxide of iron, or similar metallic pigment, and boiled linseed oil. No other ingredients, no turpentine. Clean the tank and scrape off old rust. Mix the paint, or oxide and oil, so that it will easily spread with a brush. Give the tank one coat and let it thoroughly dry for several days, then put on another coat and dry several days, when the tank will be ready for use and should last many years without showing rust. This is the universal practice here. All ships tanks are painted in this way. We do not recommend tinning or galvanizing.

(9) H. Y. asks: 1. What is the weight of a cubic foot of illuminating gas? A. 250 to 300 grains. 2. What is weight of cubic foot of air? A. 535·7 gram. 3. How much would a balloon lift made in cylinder shape, say 75 feet long by 40 feet in diameter? A. The gas alone would have a lifting power of about 3,000 pounds. But this would be reduced in effective power

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by the weight of cloth, varnish, net, car, appurtenances, etc. 4. What would be the weight of the canvas, etc., required to make the same? A. About 600 pounds.

(10) J. W. asks the kind of acid used by jewelers for soldering purposes. A. The jewelers in the United States use no acids for soft soldering except upon the cheapest class of work, upon which the ordinary tinman's acid (chloride of zinc and ammonia) is used. For fine work, borax is used for hard soldering, and Venice turpentine for soft soldering.

(11) J. S. S. asks (1) whether or not he can use type metal for a storage battery. A. Type metal is not suitable for a storage battery. You may use a little antimony alloyed with the lead. 2. What will be the cost of a pound of metallic sodium, and about what will be the bulk of that amount? A. Sodium is worth $5 a pound. The pound contains about 28 cubic inches. 3. Whether or not the atmosphere has a chemical symbol. If so, what is it? A. The atmosphere is a mixture of about four parts of nitrogen (N) with one part of oxygen (O). As it is not a chemical compound, it has no symbol.

(12) C. C. C. asks: Could a speaking tube 1 inch pipe be made to work effectually at a distance of 3,000 feet with only 1 elbow at each end? A. No. About 150 feet is as far as a one inch speaking tube will work to advantage. For a distance of 3,000 feet a 12 or 15 inch pipe would be required.

(13) S. C. M. asks (1) for an oil that will readily mix with silica, one that will not dry after it becomes old. A. Any non-drying oil, such as cotton seed, olive, or sweet almond oil. 2. A glue for pasting labels on tin. A. Freshly made gum tragacanth paste.

(14) J. M. C. asks a formula by which to prepare that fly paper that makes the victim a prisoner by its adhesiveness. A. In a tin vessel melt together one pound of resin and add two fluid drachms of linseed oil. While the mixture is warm dip a spatula into it and spread what adheres to the blade on foolscap paper. Different samples of resin require varying proportions of oil to make it spread properly.

(15) J. B. S. asks how to can corn and peas (a good recipe is wanted). A. See the article on "Canned Food" contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 499.

(16) T. N. writes: A newly filled boiler burst here recently, cause unknown. Will any mixture of air and steam form an explosive mixture? A. It will not.

(17) C. S. W., of Texas, says: I send you a specimen of a poisonous insect, which please name for me. It is principally found on fruit trees, especially the fig here, and inflicts a very poisonous wound after the manner of the centipede, by stinging with its feet. A boy 12 or 14 years of age stung by one recently suffered excruciatingly for several hours. He was stung on the third finger of the right hand, and the pains extended up his arm to the shoulder. There was very little swelling of the hand or arm. Two blue spots marked the location of the wound. The pain appeared to yield eventually to the free application of ammonia. A. Prof. C. V. Riley says: I judge, however, from the account that the insect is the blood-sucking cone nose (*Conorhinus sanguisuga*). You will find an interesting account of an experience by Professor Lemmon, of California, with this insect, in my annual report for 1884. The account is as follows: "The blood-sucking cone nose, or big bed bug (*Conorhinus sanguisuga Lec.*), is also frequently found in beds, and its bite is very severe. Professor J. G. Lemmon, of Oakland, Cal., was induced, after a botanizing exploration in the mountains of Arizona, to camp with his family in a cave." He writes: "Suddenly Mrs. Lemmon screamed, and a large, flat, nimble-footed bug was seen hurrying away into a rock crevice. It was pitiful to see the tears rolling down her cheeks as she swung her arm about, while applying ammonia to allay the pain of the wound, which immediately reddened and swelled, forming a convex surface, one inch or more across. Others were also bitten. . . The presence of this insect is not felt until the keen beak is inserted. This is very hard, over three-sixteenths of an inch long, and can, therefore, be inserted through any kind of clothing worn in summer. The swellings made soon fester, occasioning great pain and itching, and discharging pus for several days."

(18) J. W. C. asks the best mixture for hardening Bessemer steel. A. Bessemer steel should be treated in the same manner as iron for casehardening. If a very thin surface hardening only is required, smear surface with animal charcoal pulverized and wet with a solution of cyanide of potassium in soap water thick enough to make a paste. Heat to the proper temperature and harden in solution of cyanide of potassium and water (an ounce to a pail). If a deeper carbonizing is required, the pieces may be packed in animal charcoal in an iron box and given a longer time at a red heat, then raise the temperature to a cherry red and harden in the cyanide water.

(19) J. E. W.—You can do much for yourself by judicious study of books, at the same time examining the working of electrical plants in your neighborhood. A course of electrical experiments as derived from book illustrations and as published in back numbers of SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT would give you a very good understanding of the general principles of any branch of electrical science that might please your taste. A good general book to start with, if you are a novice, is Electricity and Magnetism, by Thompson, $1.25, and Electricity in Theory and Practice, by Fiske, $2.50, with many special works on Lighting, Electroplating, the Telegraph, Telephone, etc., which you will find in our book list.—You cannot mend a broken emery wheel.—To prevent hot journals, use a heavy oil or mix a little good tallow with the oil by heating.

(20) R. H. asks (1) a good paint for iron boat's bottom. A. Clean the bottom of the boat and let it dry, then paint with boiled linseed oil and an iron oxide paint which may be made darker in color with a little lampblack or plumbago finely pulverized. 2. If a boat draws six inches of water, will a propeller drive it? A. Yes. 3. If a propeller is half out of water and half in water, will it drive a boat 12 feet long? If so, how many miles an hour can boat go? A. Yes; 3 or 4 miles with 12 inch wheel. 4. My boat is 12 feet long, 4 feet wide, 2 feet in depth. What size engine will drive it 3 to 5 miles an hour? A. About a 1 horse power, such as made by the Shipman Engine Company. Advertisement in SCIENTIFIC AMERICAN. 5. What kind of propeller will answer for my boat? It draws from 4 to 6 inches of water. A. A 12 inch wheel, set to dip below the bottom of the boat 3 or 4 inches.

(21) F. M. H. asks: What is the value of an American shilling as generally understood in the United States? If different in different parts of the country, please state value in each. A. There is no American shilling, and no generally accepted value of such coin now in any part of the United States, except as relating to the value of the English shilling. Up to about 1860, from the depreciated currency of colonial times, what was called a New England or Yankee shilling, though there was no such coin, represented a value of 16⅔ cents, and this value attached to the term in many other States; in New York currency the shilling similarly represented 12½ cents, in Pennsylvania currency 13⅓ cents, and in Georgia and South Carolina 21¾ cents.

(22) J. G., Jr., asks: 1. How much pressure to the square inch will ordinary lead pipe ¾ inch internal diameter bear? A. ¾ inch lead pipe varies from 0·625 to 2½ pounds per foot. The thinnest may stand 20 to 30 pounds cold water pressure; the heaviest, 300 to 400 pounds cold water pressure. 2. How much will ordinary rubber tubing of the same size? A. Ordinary ¾ rubber tubing, 10 to 15 pounds pressure. 3. How much pressure would it be safe to carry in a brass boiler, made of a seamless drawn tube ⅛ inch thick, 6 inches diameter, and 15 inches long, heads ⅜ inch thick, riveted, with an internal flue 2½ inches diameter brazed in the heads? A. The ⅜ head is very thin for a boiler, but if properly put together, the boiler should be safe for 30 pounds steam pressure. 4. Would such a boiler when used with a little grate arranged to burn soft coal, with a good draught, run an engine 1¼ inches by 1¼ inches (slide valve)? A. The boiler would run the engine, but would do very little work.

(23) W. D. L. writes: We have a 14 foot by 3 foot mirror, which, by long continued cleaning by inexperienced hands, has become very much scratched; the scratches are not very deep, but sufficient to blur the surface. Would putty powder repolish it, and how should it be used? A. The application of fine rouge might brighten your mirror, but experience is necessary to do it properly. Apply the material with water and a soft chamois skin, and finally use the palm of the hand.

(24) A. S. L. asks what oil should be used to protect the interior of a rifle barrel from rust. A. Use vaseline. Do not forget to give the gun bore a good wash with hot water first, then dry and apply the vaseline.

(25) W. R. writes: I have a Grove battery, and I find that something is the matter with it in regard to amalgamating the zinc. The first time I amalgamated the zinc, the mercury stuck very well, but the next time I found the mercury would not stick at all. On the inside of the zinc, where the porous cell fits, the mercury was corroded. A. You probably started without having the inside surface of the zinc well amalgamated. Clean it off with some sand rubbed on with a stick and reamalgamate, using dilute acid with the mercury, and rubbing the latter on with a strip of galvanized iron.

(26) F. E. F. asks: How many cubic inches of gas will 1 gallon (231 cubic inches) of No. 74° gasoline produce? Could you give me a formula to work it out? A. About 70 cubic feet. No reliable formula can be given.

(27) F. S. D. B. writes: In a round chimney 335 feet high, 28 feet diameter at the base, and 14 feet at the apex, how much will be the oscillation of the chimney at the apex? A. The oscillation of a chimney of your description from unequal heating by the sun depends much upon the thickness of the walls, thin walls oscillating more than thick ones. For such a chimney properly constructed, 2 to 3 inches would probably cover the movement in this latitude.

(28) R. T. K. asks: Could a small cupola be made so as to melt 100 pounds of iron? What should be its dimensions? A. Small cupolas for melting 100 to 200 pounds iron have been made for experimental purposes. They should be 12 inches diameter inside, 4 feet high, having 2 tuyeres with 1 inch nozzles, 2 inch wind pipe, and using No. 1 Sturtevant blower, which requires ⅛ horse power. Place the tuyeres 5 inches above the hearth for a 100 pound melt.

(29) W. W. asks the proper size of steam pipe and ports for an engine having a cylinder 2 by 3 inches. A. For high speed engines a good rule is to make the steam ports 0·07 of the area of the cylinder. Exhaust port double the width of the steam port. For your engine, 2 inches by 3 inches, the required area is 3 inches × 0·07 = 0·21 square foot, or a little over one-fifth of a square inch. For small engines the ports should be half the diameter of the cylinder in length, or one inch by three-sixteenths inch full for your cylinder.

(30) C. F. H. asks a receipt for mixing so-called copper paint to keep bottom of vessels from fouling. A. Buy fine copper bronze and mix it with a good wearing body varnish that is not affected by water, and you will have the best kind of a copper paint for ship bottoms.

(31) A. F. L. writes: I have a common duck legging that comes to the knee, of 10 ounce duck. Now I desire to make this waterproof, and at the same time soft and pliable. Please let me know how to do it. A. Immerse the leggings in a bath of 4° to 5° B. of acetate of alumina prepared by dissolving hydrate of alumina in acetic acid. They are allowed to remain in the bath for one hour, then pressed dry, and to expel the acetic acid from the combination, exposed to a temperature of 230° to 248° Fah. in a steam box.

(32) W. A. wishes good recipes for making birch beer and ginger ale. A. See article on "Effervescing Beverages" in SCIENTIFIC AMERICAN SUPPLEMENT, No. 270.

(33) A. M. D. desires a receipt for making and coloring sirup used in making milk shake, soda water, etc. A. The ingredients are simply milk, ice, and flavoring sirup, which yields the color.

(34) R. G. asks what ingredient to use in the manufacture of ink for writing machine ribbons, so they may resist the action of a damp atmosphere, as in wet weather I find that the glycerine rises to the surface of the ribbons, thereby causing them to smear the paper badly. A. Use vaseline in lieu of glycerine.

(35) J. M. U. asks: Is there a simple and harmless process by which rough or ridged finger nails may be made smooth? A. The ridges can almost always be rubbed down with moistened pumice stone. The nail brush ought not to ridge the nails.

(36) H. W. P. writes: Will you oblige a constant reader with some information as to the process of making crucibles out of lime? A. Cut them out of solid lumps of lime and drill out the interior cavity.

(37) J. W. T. N. asks: Can you state what is a fair estimate (with ordinary city pressure) for consumption of gas per hour, with the various sized common burners, and with Argand ditto? Also, what candle power they respectively represent? A. Allow five to seven cubic feet per hour consumption for each burner; and from sixteen candles to twenty or more, according to the quality of the gas.

TO INVENTORS.

An experience of forty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

July 24, 1888,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Advertising novelty, W. Diebel ... 386,773
Air, apparatus for moistening and cleaning, W. Griesser ... 386,777
Air brake, F. Lansberg ... 386,640
Album, F. Reifschneider ... 386,607
Aluminum fluoride, manufacture of, L. Grabau ... 386,704
Ammunition boxes, composite transom for, H. P. Elwell ... 386,696
Anvil, J. O'Brien ... 386,755
Axle box, L. D. Clark ... 386,525
Axle, car, S. Gissinger ... 386,460
Bag or satchel frame, W. Roemer ... 386,789
Baling crib, C. E. Mitchell ... 386,649
Bar. See Grate or ash pan bar.
Barometric reservoir, F. Rhind ... 386,657
Bath. See Photographic bath.
Batteries, porous cup for electric, B. J. & J. W. Wheelock ... 386,569
Battery. See Storage battery.
Bearing, anti-friction, T. F. Flinn ... 386,698
Bedstead, folding, E. T. Smith ... 386,662
Bell or alarm, call, V. A. Germain ... 386,632
Bench. See Wash bench.
Bicycle, tandem, T. O'Brien ... 386,601
Binder, temporary, W. E. Weeks ... 386,513
Blast or exhaust apparatus, J. Y. Smith ... 386,502
Blower and chimney draught controller, combined, C. M. Currier ... 386,529
Bobbin winding machine, J. McCreary ... 386,644
Boiler. See Steam boiler. Wash boiler.
Boiler heating apparatus, burner for steam, W. Walton ... 386,568
Boot drier, G. A. Hess ... 386,746
Boot or shoe sole, A. Hanvey ... 386,778
Boring machine, W. D. Tripp ... 386,566
Box. See Axle box. Letter box. Sheet metal box.
Brake. See Air brake. Car brake. Vehicle brake.
Brake mechanism, fluid pressure automatic, G. B. Williams ... 386,514
Bridge gate, draw, A. L. Peirce ... 386,491
Bucket, mud, J. R. Hall ... 386,537
Buggy boot, F. Senieur ... 386,660
Burner. See Gas burner. Vapor burner.
Bustle, K. Hendricks ... 386,744
Button, H. B. Robinson ... 386,559
Button, W. F. Whiting ... 386,763
Button making machine, C. A. Pfenning ... 386,493
Button or stud, W. F. Whiting ... 386,762, 386,764
Cable grip device, J. T. Hodgins ... 386,585
Cables, splicing, J. Collins ... 386,690
Camera shutter, Bliss & Middleton ... 386,449
Can. See Milk can. Oil can. Refrigerator can.
Can heading machine, J. Solter ... 386,760
Car brake, H. Brockman ... 386,766
Car brake, C. W. Lanpher ... 386,639
Car brake, W. B. Turner ... 386,793
Car coupling, W. H. Griffith ... 386,582
Car coupling, G. Strader ... 386,790
Car coupling, A. Switzer ... 386,505
Car door, J. W. Shewmaker ... 386,611
Car heater, J. & G. F. Allen ... 386,734
Car, railway, E. Verstraete ... 386,512
Cars around curves of cable railways, apparatus for moving, W. A. Phillips ... 386,654
Cars, current receiver for electric railway, J. A. Enos ... 386,581
Cars, street or station indicator for, I. H. Miller ... 386,486
Card grinder, J. Bishop ... 386,521
Carrier apron, endless, L. Miller ... 386,551
Carving machine, S. Y. Kittle ... 386,710
Case. See Latch case. Nail case. Show case.
Centrifugal machine, G. C. Roberts ... 386,758
Check loop, side, H. Lowe ... 386,480
Churn, W. F. Cornelius ... 386,575
Churn, O. G. Newton ... 386,650
Churn, T. S. Urie ... 386,616
Cider purifier, J. W. Williams ... 386,515
Cigar cutter, Young & Thomas ... 386,733
Clamp. See Floor clamp.
Clamp, Garrison & Reukauff ... 386,681
Cleaner. See Flue cleaner. Slate cleaner.
Clocks by the variations of temperature, device for winding, I. L. Roberts ... 386,557
Coal and grain distributing apparatus, G. H. Ramsay ... 386,655
Coffi fastener, C. A. Conklin ... 386,691
Coffin fastener, J. P. Lein ... 386,641
Coin assorter and deliverer, T. Carney ... 386,453
Coloring substances by the reaction of aromatic hydrazin sulphonic acids on retenchinon, production of, W. Kelbe ... 386,709
Comb. See Curry comb.
Commode, earth closet, or similar appliance, C. L. Doll ... 386,578
Condenser, V. H. Becker ... 386,447
Condenser, smoke, B. Roberts ... 386,498
Condiment mill, D. C. Ripley ... 386,722
Cores, device for moulding, R. A. Regester ... 386,606
Cotton openers, etc., evening mechanism for, J. C. Potter ... 386,756
Couplers, manufacture of, J. H. Simpson ... 386,725
Coupling. See Car coupling. Pipe or tube coupling.
Cuff, apparel, W. Kahler ... 386,637
Cultivator, H. M. Godfrey ... 386,702
Cultivator, A. J. Olney ... 386,489
Cultivator, H. N. Timms ... 386,507
Cultivator, sulky, J. A. Hazlewood ... 386,583
Curculio catcher, H. Lutts ... 386,546
Curry comb, G. W. Blythe ... 386,573
Cutter. See Cigar cutter. Paper cutter. Rotary cutter.
Cutting press, W. G. Entrekin ... 386,459
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Harrow, Melson & Harper ... 386,598
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Holder. See Lamp shade holder. Pencil holder. Ticket holder. Type line holder.
Hook. See Meat hook.
Hoop. See Tub hoop.
Horse boot, J. H. Fenton ... 386,630
Hot air feeder, Clark & King ... 386,527
Indicator. See Station indicator.
Induction coil, coin operated, Williams & Roovers (r) ... 10,949
Inductometer, G. Miot ... 386,648
Ironer, neckband, A. T. Hagen ... 386,706
Jack. See Lifting jack.
Jar. See Fruit jar.

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Key. See Telegraph key. Turn key.
Knife sharpener, Johnson & Stewart 386,544
Knitting machines, latch opener for, L. Jones, Jr. 386,636
Lacing cord fastener, C. A. Preston 386,496
Lacing, corset, A. S. Mann 386,642
Lamp, H. E. Shaffer 386,758
Lamp, E. Tooey 386,508
Lamp, central draught, F. Rhind 386,658
Lamp, miner's safety, T. Shaw 386,661
Lamp shade, S. R. Kneeland 386,475
Lamp shade holder, W. E. Brown 386,686
Lamp, signal, A. F. Prahm 386,495
Lantern, signal, A. H. Mulliken 386,715
Latch, J. H. & T. D. Morris 386,554
Latch case, C. W. Bullard 386,522
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Leather, machine for the treatment of, H. Thurlow 386,667
Lemon squeezer, A. Edie 386,694
Letter box, R. F. Regester 386,757
Levers, device for operating a set of, H. D. Ganse 386,776
Lifting jack, E. Foust 386,533
Lifting jack, A. A. Strom 386,791
Lime vat agitator, A. A. Myers 386,488
Lime kiln, E. Solvay 386,665
Liquors, aging, W. L. Horne 386,748
Lock. See Nut lock. Seal lock.
Lock, G. G. Smith 386,501
Lock, C. R. Uhlmann 386,511
Loom, S. T. & W. S. Thomas 386,506
Loom dobby, W. Williamson 386,731
Loom for cross weaving, C. A. Littlefield 386,477
Loom picker, L. A. Carver 386,688
Loom shuttle, L. W. Fifield 386,531
Looms, lag for patten chains of, K. Jowett 386,472
Lubricator. See Sight feed lubricator.
Lumber trimmer, M. Garland 386,701
Malt turning apparatus, Hauser, Sr., & Depew 386,467
Manholes and catch basins, cover for, J. J. Burrows 386,768
Measuring and registering device, grain, F. H. Ehlers 386,695
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Music stand, folding, J. H. Macke, Jr. (r) 10,947
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Ore separator, A. P. Granger 386,741
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Pump, oscillating, L. J. P. Pontallie 386,717
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Radiator, C. H. Robinson 386,558
Radiators, vent plug for steam, E. P. Waggoner 386,670
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Railways, construction of, Wood & Fowler 386,732
Railways, overhead wire connection for electric, W. H. Knight 386,784
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Ring. See Nose ring.
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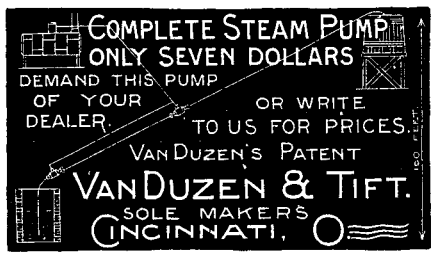

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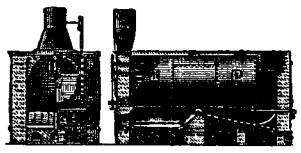

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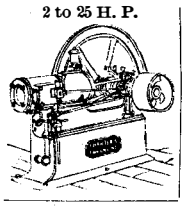
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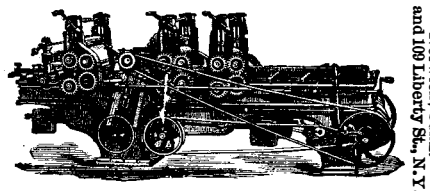
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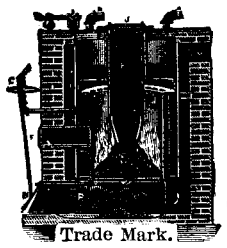
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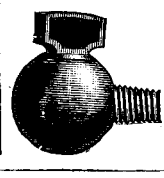
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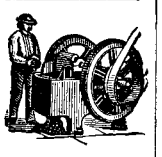

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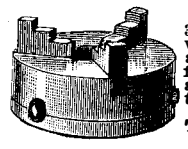
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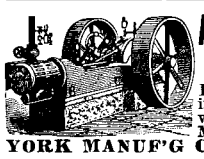
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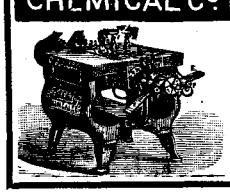

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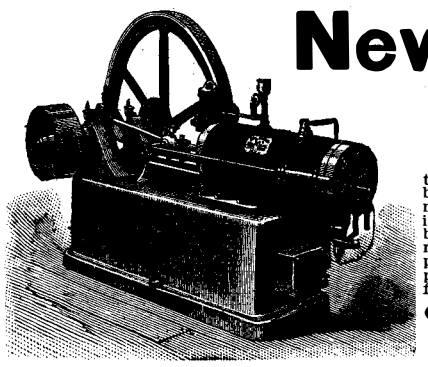

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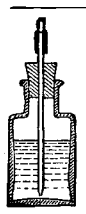

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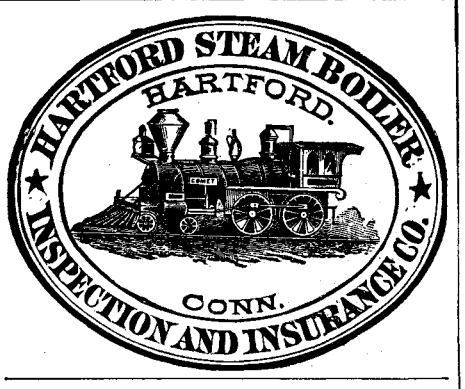

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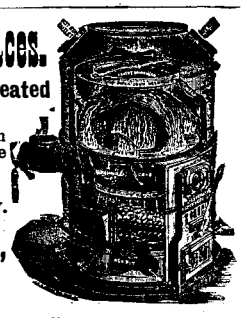

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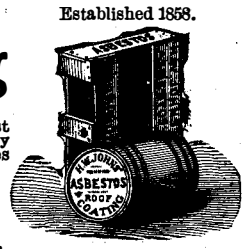

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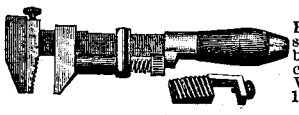

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